STATE OF CALIFORNIA
DEPARTMENT OF CONSUMER AFFAIRS
BUSINESS, CONSUMER SERVICES, AND HOUSING AGENCY • GAVIN NEWSOM, GOVERNOR
DENTAL HYGIENE BOARD OF CALIFORNIA
2005 Evergreen Street, Suite 1350 Sacramento, CA 95815
P (916) 263-1978 | F (916) 263-2688 | www.dhbc.ca.gov

Notice is hereby given that a public meeting of the
Dental Hygiene Board of California (DHBC) will be held as follows:

DHBC Public Teleconference Meeting Agenda

Saturday, April 23, 2022
10:30 a.m. - Adjournment

Members of the public may listen or participate using the link below or attend one of the listed physical locations for the meeting. Due to potential technical difficulties, please consider submitting written comments via email at least five business days prior to the meeting to elizabeth.elias@dca.ca.gov for consideration.

Instructions for Meeting Participation

The DHBC will conduct the meeting via WebEx computer program. The preferred audio connection is via telephone conference and not the microphone and speakers on your computer. The phone number and access code will be provided as part of your connection to the meeting. Please see the instructions attached hereto to observe and participate in the meeting using WebEx from a Microsoft Windows-based PC.

For all those who wish to participate or observe the meeting, please log on to the website below. If the hyperlink does not work when clicked on, you may need to place the cursor on the hyperlink, then right click. When the popup window opens, click on Open Hyperlink to activate it, and join the meeting.

https://dca-meetings.webex.com/dca-meetings/j.php?MTID=m7bf44ab515c8081a3c36259e36c60d8c

Webinar number: 2495 468 3118 Webinar password: DHBC04232022

Audio conference: US Toll Number: +1-415-655-0001
Access code: 249 546 83118
Passcode: 34220423

Members of the Board

President – Dr. Carmen Dones, RDH Educator Member
Vice President – Noel Kelsch, RDHAP Member
Secretary – Denise Davis, Public Member
RDH Member – Nicolette Moultrie
RDH Member – Evangeline Ward
Public Health Dentist Member - Dr. Timothy Martinez
Public Member – Susan Good
Public Member – Garry Shay
Public Member – Erin Yee

DHBC TELECONFERENCE MEETING LOCATIONS	
DHBC Headquarters Building **2005 Evergreen Street, 1st Floor** **Hearing Room** **Sacramento, CA 95815**	**Lafayette Library and Learning Center** **3491 Mount Diablo Blvd.** **Library Study Room** **Lafayette, CA 94549**
West Los Angeles College **9000 Overland Avenue** **Building MSA, Room 103** **Culver City, CA 90230**	**Martinez Public Library** **Library Study Room** **740 Court Street** **Martinez, CA 94553**
Santa Barbara Central Library **Library Study Room** **40 East Anapamu Street** **Santa Barbara, CA 93101**	**Sherwin Williams Paint Store** **Break Room** **408 Front Street** **Santa Cruz, CA 95060**
Deputy Ken Collier Park **9206-9236 Via De Cristina** **Santee, CA 92071**	

The DHBC welcomes and encourages public participation in its meetings. Please see public comment specifics at the end of this agenda.

The DHBC may act on any item listed on the agenda, unless listed as informational only. All times are approximate and subject to change. Agenda items may be taken out of order to accommodate speakers and to maintain a quorum. The meeting may be cancelled without notice.

Agenda

1. Roll Call & Establishment of Quorum.

2. Public Comment for Items Not on the Agenda.
   [The DHBC may not discuss or act on any matter raised during the Public Comment section that is not included on this agenda, except whether to decide to place the matter on the agenda of a future meeting (Government Code sections 11125 & 11125.7).]

3. Discussion and Possible Action to Approve the March 19, 2022, Full Board Webex Teleconference Meeting Minutes.

4. Discussion and Possible Action on the Following Legislation: Assembly Bill 2276 Carrillo - Dental Assistants.

5. Future Agenda Items.

6. ***Closed Session – Full Board***

   The Board may meet in Closed Session to deliberate on disciplinary matters pursuant to Government Code section 11126, subdivision (c)(3). If there is no closed session at this meeting, it will be announced.

7. Adjournment.

Public comments will be taken on the agenda items at the time the specified item is raised. Government Code section 11125.7 provides the opportunity for the public to address each agenda item during discussion or consideration by the Board prior to the Board taking any action on said item. Members of the public will be provided appropriate opportunities to comment on any issue before the Board, but the Board President may, at his or her discretion, apportion available time among those who wish to speak. Individuals may appear before the Board to discuss items not on the agenda; however, the Board can neither discuss nor take official action on these items at the time of the same meeting (Government Code sections 11125, 11125.7(a)).

A person who needs a disability-related accommodation or modification to participate in the meeting may make a request by contacting Elizabeth Elias, Assistant Executive Officer, at 916-263-2010, or email elizabeth.elias@dca.ca.gov or send a written request to the DHBC at 2005 Evergreen Street, Suite 1350, Sacramento, CA 95815. Providing your request at least five business days prior to the meeting will help to ensure availability of the requested accommodation.

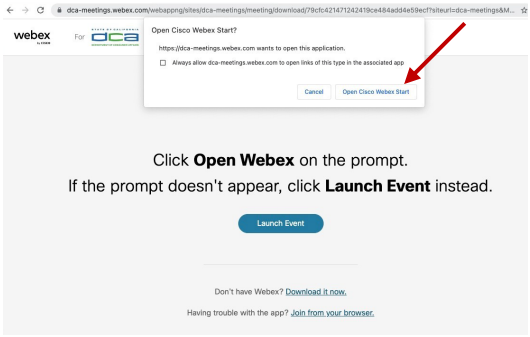
Webex QuickStart

Getting Connected

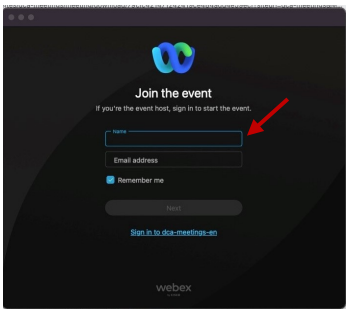
If joining using the meeting link

1. Click on the meeting link. This can be found in the meeting notice you received.

2. If you have not previously used Webex on your device, your web browser may ask if you want to open Webex. Click "Open Cisco Webex Start" or "Open Webex", whichever option is presented.
   DO NOT click "Join from your browser", as you will not be able to participate during the meeting.



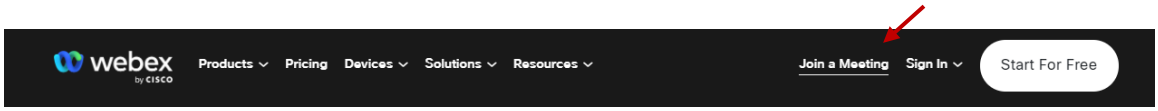
3. Enter your name and email address.
   Click "Join as a guest" .
   Accept any request for permission to use your microphone and/or camera.



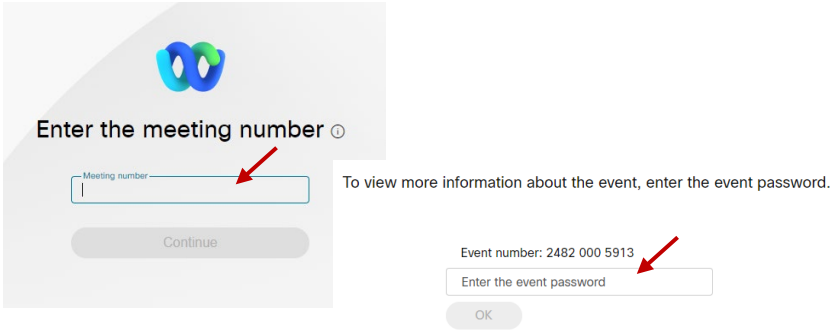
OR

If joining from Webex.com

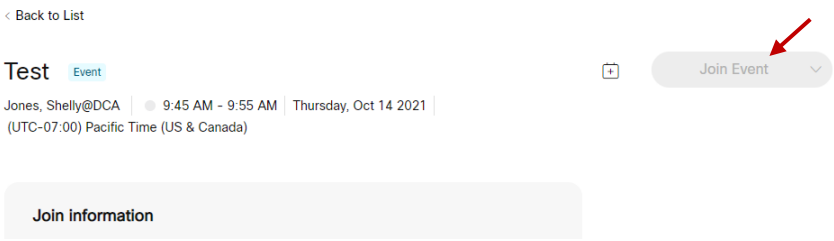
1. Click on "Join a Meeting" at the top of the Webex window.



2. Enter the meeting/event number and click "Continue" . Enter the event password and click "OK" . This can be found in the meeting notice you received.



3. The meeting information will be displayed. Click "Join Event" .



OR

Connect via telephone:

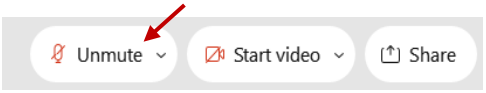
You may also join the meeting by calling in using the phone number, access code, and passcode provided in the meeting notice.

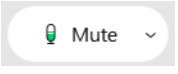
Webex QuickStart

Audio

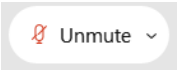
Microphone

Microphone control (mute/unmute button) is located on the command row.





Green microphone = Unmuted: People in the meeting can hear you.

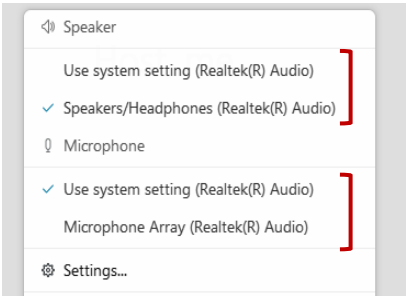


Red microphone = Muted: No one in the meeting can hear you.

Note: Only panelists can mute/unmute their own microphones. Attendees will remain muted unless the moderator enables their microphone at which time the attendee will be provided the ability to unmute their microphone by clicking on "Unmute Me".

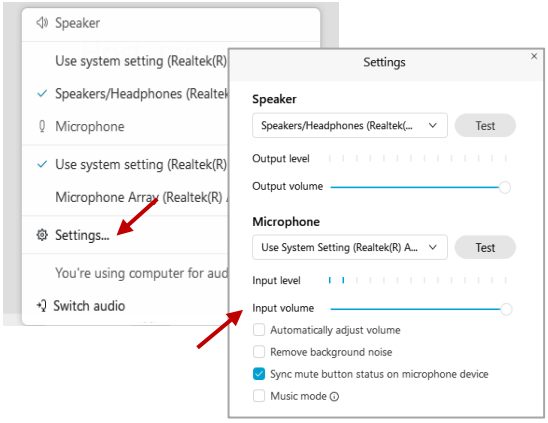
If you cannot hear or be heard

1. Click on the bottom facing arrow located on the Mute/Unmute button.
2. From the pop-up window, select a different:
   - Microphone option if participants can't hear you.
   - Speaker option if you can't hear participants.



If your microphone volume is too low or too high

1. Locate the command row – click on the bottom facing arrow located on the Mute/Unmute button.
2. From the pop-up window:
   - Click on "Settings…":
   - Drag the "Input Volume" located under microphone settings to adjust your volume.

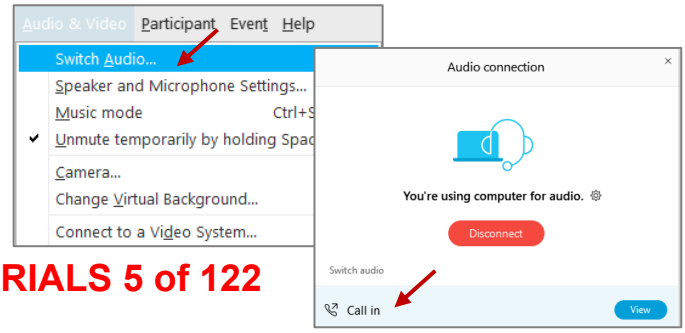


Audio Connectivity Issues

If you are connected by computer or tablet and you have audio issues or no microphone/speakers, you can link your phone through webex. Your phone will then become your audio source during the meeting.

1. Click on "Audio & Video" from the menu bar.

2. Select "Switch Audio" from the drop-down menu.

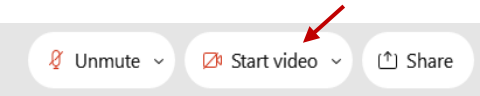


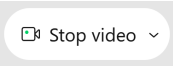
3. Select the "Call In" option and following the directions.

Web Camera

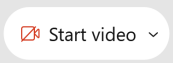
Only panelists (e.g. staff, board members, presenters) can access the web camera feature.

Camera control (Start Video/Stop Video button) is located on the command row.





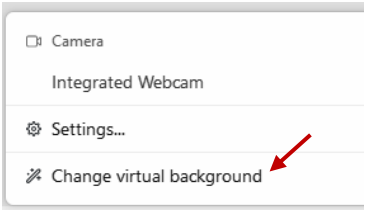
Green dot in camera = Camera is on: People in the meeting can see you.



Red dot in camera = Camera is off : No one in the meeting can see you.

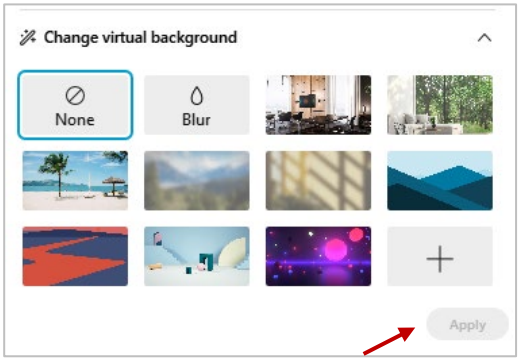
Virtual Background

1. To access virtual backgrounds, click on the bottom facing arrow located on the video button.



2. Click on “Change Virtual Background”.

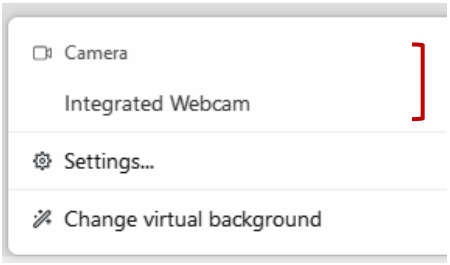
3. From the pop-up window, click on any of the available images to display that image as your virtual background and click “Apply”.



If you cannot be seen

1. Locate the command row – click on the bottom facing arrow located on the video button.

2. From the pop-up window, select a different camera from the list.



DHBC
Dental Hygiene
Board of California

Member	Present	Absent
Denise Davis		
Carmen Dones		
Susan Good		
Noel Kelsch		
Timothy Martinez		
Nicolette Moultrie		
Garry Shay		
Evangeline Ward		
Erin Yee		

Saturday, April 23, 2022

Dental Hygiene Board of California

Agenda Item 1

Roll Call & Establishment of Quorum

Board Secretary to call the Roll.

Saturday, April 23, 2022

Dental Hygiene Board of California

Agenda Item 2

Public Comment for Items Not on the Agenda.

[The Board may not discuss or act on any matter raised during the Public Comment section that is not included on this agenda, except whether to decide to place the matter on the agenda of a future meeting (Government Code Sections 11125 & 11125.7(a)]

Dental Hygiene Board of California
Teleconference Meeting Minutes

DRAFT

Saturday, March 19, 2022

Pursuant to the provisions of Governor Gavin Newsom's Executive Order N-08-21, dated June 11, 2021, neither a public nor teleconference location was provided. Members of the public observed and participated by using the link that was provided in the agenda.

DHBC Members Present:

President – Dr. Carmen Dones, Registered Dental Hygienist (RDH) Educator Member
Secretary – Denise Davis, Public Member
RDH Member – Nicolette Moultrie
RDH Member – Evangeline Ward
Public Health Dentist Member – Dr. Timothy Martinez
Public Member – Susan Good
Public Member – Garry Shay
Public Member – Erin Yee

DHBC Member Absent:

Vice President – Noel Kelsch, Registered Dental Hygienist in Alternative Practice (RDHAP) Member

DHBC Staff Present:

Anthony Lum, Executive Officer
Elizabeth Elias, Assistant Executive Officer
Adina Pineschi-Petty, Doctor of Dental Surgery (DDS), Educational, Legislative, and Regulatory Specialist
Albert Law, Special Investigator
Michael Kanotz, Department of Consumer Affairs (DCA) Legal Counsel for the DHBC
Danielle Rogers, DCA Regulatory Unit Legal Counsel for the DHBC

1. Roll Call and Establishment of a Quorum

Dr. Carmen Dones, President of the Dental Hygiene Board of California (DHBC, Board), reviewed teleconference meeting guidelines and called the meeting to order at **9:00 a.m.** Secretary Denise Davis completed the roll call and a quorum was established with 8 members present. Board member Noel Kelsch was absent and excused. At 12:40 p.m. Denise Davis and Susan Good were excused from the meeting. The meeting continued with a quorum of 6 members present for the duration of the meeting.

2. Public Comment for Items Not on the Agenda.

JoAnn Galliano, on behalf of the California Dental Hygienists' Association (CDHA), requested for the Board to take an opposition position on Assembly Bill 2276 authorizing

dental assistants to polish the coronal surfaces of teeth or apply pit and fissure sealants, under the direct supervision of a licensed dentist, when the dental assistant has completed specified training and provided evidence of the completion of that training to the Dental Board of California (DBC).

Paula Lee, on behalf of CDHA's Government Relations Counsel (GRC), requested for the Board to collect current and accurate workforce data on active practice of RDHAPs, along with RDHAP mobile and portable equipment use data.

3. President's Report (Informational Only).

President Dr. Carmen Dones welcomed all in attendance and provided a report on her current activities. Dr. Dones reported she attended the DBC's February 11-12, 2022, meeting. She stated as Dr. Timothy Martinez, past Dental Hygiene Board of California (DHBC, Board) President, presented a thorough report on DHBC activities at their November 2021 meeting, she did not provide a DHBC report to the DBC at this meeting. She stated she will provide an updated report about DHBC activities at the DBC's next meeting.

Dr. Dones reported that on February 22, 2022, she participated in the Department of Consumer Affairs (DCA) President's Training where DCA executive staff provided information, served as a forum to share best practices, and heard from past Presidents about their experiences presiding over a Board. She stated this session was very informative, and she'd like to thank DCA for conducting the training.

Dr. Dones stated that on March 10, 2022, she co-hosted an Alternative Pathways to Licensure Taskforce meeting to ensure the issue continues to be addressed. She stated it was an extremely productive meeting and that there will be an update from the taskforce later in the meeting. Dr. Dones reported the taskforce has met five times and looked forward to further productive discussions to present a recommendation to the Licensing Committee and subsequently, the Board in the future.

Dr. Dones reported that she and Executive Officer (EO) Lum have met on a regular basis every other week. She stated that staff continue to complete the Board's work and today's teleconference meeting is needed to ensure projects are moving forward to meet upcoming deadlines. She stated that the proposed regulations placed on the agenda in the meeting are the most important items to be addressed so they can continue to move through the regulatory process. She stated that the current legislation placed on the agenda for this meeting is in the early stages, and that if the Board takes positions, it must ensure the version of the bill the position is based upon is correct prior to submitting the position letter to the author.

Dr. Dones reminded the Board that this is the Board's Sunset year, as the original Sunset date was delayed a year due to the pandemic. She stated that staff will be completing the draft report for the Board's review later this year and will probably require an additional

meeting sometime in September to review, and if needed, to revise the report for staff to finalize and present at the November 2022 meeting.

Dr. Dones stated that today's meeting may be the last conducted solely through Webex teleconference due to the pandemic, as the Governor's executive order to conduct public meetings through teleconference without having to notice each member's location expires on March 31, 2022, unless extended. She stated there is new legislation that was introduced in the current session (Assembly Bill 1733 by Assembly Member Quirk) addressing the modification of the Open Meetings Act that will be explained by staff later in the meeting. She indicated that since the bill is under consideration at this time and not yet approved, and with the teleconference executive order expiring this month, the Board is planning to conduct its July 2022 meeting in person, depending upon the environment pertaining to public gatherings.

Dr. Dones stated that with the state's decrease in Coronavirus Pandemic (COVID-19) infections, she wants everyone to be safe and to follow standard protocols wherever those in attendance go.

Board member comment: None.

Public comment: None.

4. Update from the Department of Consumer Affairs (DCA) Executive Staff (Informational Only).

Brianna Miller, representative from the Department of Consumer Affairs (DCA) Board and Relations Office, reported:

1. Update on COVID-19 Safety Measures:
   DCA thanked Board members and staff who have continued to serve the public during the COVID-19 pandemic. As the pandemic moves into an endemic, new State public health guidance relaxed mandatory face coverings, however, masks are still strongly encouraged in indoor settings and stated that in some high-risk settings such as healthcare facilities, face coverings are required regardless of vaccination status. Local orders may be more restrictive to respond to local community conditions, and DCA requested for all to be aware of current guidelines and as a State representative, are all expected to adhere to State and Local orders while carrying out our duties.

2. Remote Meetings:
   On January 5, 2022, Governor Newsome signed an executive order extending the Sunset date set in Assembly Bill (AB) 361 allowing boards and committees to meet remotely through March 31, 2022. On January 31, 2022, Assembly Member Quirk introduced new legislation in AB 1733 which would permanently allow boards and committees to meet remotely, while also providing virtual and physical options for members of the public to participate. If AB 1733 is passed by the Legislature and signed by the Governor, the changes would take place immediately.

3. Vaccination Verification for In-Person Meetings.
   Boards should prepare to begin offering in-person meetings after March 31, 2022. Before attending any in-person board meeting, members must verify full vaccination status with DCA's Office of Human Resources or participate in COVID-19 testing prior to the meeting. If any of the Members have not done so, please submit the proof of vaccination, as their participation will assist DCA in planning for testing at future meetings.

4. DCA Headquarters (HQ) Building Changes
   Beginning March 24, 2022, the DCA HQ Building 1 Hearing Room will be available for board meetings, as it was previously used for COVID-19 testing. DCA has reopened the HQ Building 1 Hearing Room to support upcoming in-person board meetings. Additionally, the HQ Building 1 and HQ Building 2 Hearing Rooms support hybrid meeting functionality and DCA continues to explore resources and how they may assist boards to support additional hybrid meeting locations in the future.

5. DCA Regulations Unit (Unit)
   The DCA's Regulations Unit was created in 2020 to assist the regulatory needs of DCA's boards, bureaus, committees, and commissions, while also improving the quality of the regulations. Ms. Miller reported that prior to establishment of the Unit, boards and bureaus completed only 18 regulations in 2019. After the unit was established, DCA tripled the number of regulations completed in 2020 and 2021, and, unlike in prior years, no rejections were experienced by the Office of Administrative Law. The Unit, now in its third year, will continue to build on the successes of the first two years, and increase the pace with even more regulations to be completed this year. The Unit created additional management tools and will track all regulations from start to finish to ensure complete transparency within the process.

6. Enlightened Licensing Project
   The workgroup was created in 2020 to utilize Subject Matter Experts (SMEs) within DCA to help individual boards and bureaus streamline their licensing processes more effective and efficient by utilizing best practices, information technology, and cost saving measures. The workgroup completed their review of the Board of Registered Nursing, and a report will be released this month. This report will provide recommendations which can be used by all boards and bureaus to improve their processes. After this work is complete, the workgroup will begin assisting another board or bureau with the same process.

7. DCA's Compliance and Equity Officer
   Tonya Corcoran was assigned to serve as DCA's first Compliance and Equity Officer, effective March 2, 2022. This position will oversee SOLID Training and Planning Solutions, Organizational Improvement Office, Equal Employment Opportunity Office, and the Internal Audits Office. Bringing these offices together under Ms. Corcoran's experienced leadership will be a tremendous benefit, allowing DCA to better identify and

analyze emerging issues department wide and provide timely solutions for DCA's boards, bureaus, and divisions.

8. Board Member Trainings
   A reminder to Board members that they are responsible for training and reporting requirements. The Fair Political Practices Commission's Form 700 is required by law to be filed each year before the April first deadline. Ms. Miller reported that the Board has fully complied with required filing requirements and thanked the Board for their efforts to meet this mandate.

Board member comment: None.

Public comment: None.

5. Discussion and Possible Action to Approve the January 22, 2022, Full Board WebEx Teleconference Meeting Minutes.

Motion: Nicolette Moultrie moved to approve the January 22, 2022, Full Board WebEx Teleconference Meeting Minutes with the amendment adding "due to technical difficulties" after "Agenda item 7" in Agenda Item 1 "Roll Call and Establishment of a Quorum".

Second: Garry Shay

Member discussion: Susan Good requested amendment adding "due to technical difficulties" after "Agenda item 7" in Agenda Item 1 "Roll Call and Establishment of a Quorum" regarding her attendance.

Public comment: None.

Vote: Motion to approve the January 22, 2022, Full Board WebEx Teleconference Meeting Minutes. Passed 8:0:1.

Name	Aye	Nay	Abstain/Absent
Denise Davis	X		
Carmen Dones	X		
Susan Good	X		
Noel Kelsch			X (Absent)
Timothy Martinez	X		
Nicolette Moultrie	X		
Garry Shay	X		
Evangeline Ward	X		

Name	Aye	Nay	Abstain/Absent
Erin Yee	X		

6. Executive Officer's Report (Informational Only).

Executive Officer (EO) Anthony Lum reported on the following:

a) Coronavirus Pandemic (COVID-19)

1) Office Operations:

Staff continues to use a hybrid telework schedule where they rotate 3 days in the office and 2 teleworking days except for the Board's receptionist, who's required to be in the office every day to maintain the public counter. Additionally, to comply with the Governor's mandate that all state employees be vaccinated or tested weekly, EO Lum updated the Board on DCA's schedule and process for COVID-19 testing and policies for Board staff.

2) Approved Waivers:

Pursuant to the Governor's Executive Order N-39-20, during the State of Emergency, the Director of DCA may waive any statutory or regulatory professional licensing requirements pertaining to individuals licensed pursuant to Division 2 of the Business and Professions Code, including requirements related to the education, training, and experience necessary to obtain licensure. With COVID-19 cases decreasing, the administration's intent is to wind down from the use of waivers that deferred licensing requirements and return to pre-pandemic processes and requirements.

a) Continuing Education (CE) Waivers:

Licensees who had a CE deficiency to renew their license at the time of expiration starting March 30, 2020, through September 30, 2021, have 6 months from the effective date of the waiver (DCA 21-175: signed July 26, 2021) to complete the deficient CE hours. The end date of this waiver was January 31, 2022, for those licensees to complete their deficient CE hours since the deadline wasn't extended.

A second CE waiver (DCA 21-194) was signed on September 28, 2021, that provides an extension of the CE waiver specifically to individuals whose licenses expired between October 1 and October 31, 2021. The waiver deadline for those licensees to complete the deficient CE hours for their October 2021 expiration is March 31, 2022, which is six months from the signed date of the waiver. Any new CE hours used to credit the deficiency from the last license renewal are in addition to what is required for the next license renewal for their respective license.

b) CE Restriction Waiver for Dental Professionals:

On September 8, 2020, waiver number DCA 20-55 waived the limiting number of internet-based CE coursework for dental professionals to apply toward a license renewal. The law allows up to 50% to be completed online or recorded; however, during the pandemic, the waiver allowed licensees to complete all their CE requirements through online methods. This waiver was extended once but now will expire on March 31, 2022, and the CE requirements will return to pre-pandemic methods where a maximum of 50% of the CE hours can be completed through internet or web-based methods pursuant to CCR, title 16, section 1017, subdivisions (h)&(i) starting with April 2022 renewals.

c) Wet Laboratories for Prerequisite Biomedical Science Courses:

The currently approved Wet Laboratory waiver (DCA 21-186) that was implemented on July 13, 2020, due to the pandemic and extended several times, will end permanently as of March 31, 2022. Upon review of this section of law, the law requires a wet laboratory component be completed for the biomedical science prerequisite courses; however, it does not state the methodology that's required to complete it, so it can be done through a traditional wet laboratory on campus or through online methods with a kit. Many of the pre-dental hygiene students and educational programs alike have questions about this waiver ending, especially mid-term, but that the students will receive credit for the wet lab provided the educational institution accepts it.

All currently approved waivers and pandemic information can be reviewed through a link on DHBC's website homepage at www.dhbc.ca.gov or the California Department of Public Health's website at www.cdph.ca.gov.

3) Personnel:

The Board continues to pursue the hiring of staff and currently have two vacancies. There is one vacancy in enforcement and the second vacancy is an administration position. The Board recently advertised for both and will review the applications received shortly. Staff will work with DCA's Office of Human Resources through the hiring process to fill these positions.

The Board recently met with the DCA Budget Office, and they informed staff that the two Budget Change Proposals (BCPs) submitted by the Board last year were approved for two additional positions. The first BCP is to address the mandates from Senate Bill 534 which authorizes the Board to review and inspect RDHAP mobile dental hygiene clinics, mobile dental equipment, and stand-alone dental hygiene clinics to ensure they are compliant of the law. The second BCP is to address the Board's large continuing education (CE) audit workload. As the Board initiated a fulltime CE audit program, staff was anticipating a fairly large number of licensees to be out of compliance with CE requirements for license renewal. It was discovered that over 35% of licensees randomly selected for an audit were out of compliance, which in turn created an extensive workload that a single analyst is not able to

address. Therefore, the approval of a second CE auditor was submitted and approved to assist in decreasing the workload.

4) Budget:

EO Lum provided the latest Budget Expenditure and Revenue Reports to the Board and reported the DHBC's current year budget along with a forecast of the anticipated amount to be spent for the rest of the year. He stated that the revenue amount will fluctuate throughout the year depending on the number of license renewals and applications the Board receives in a given month.

Additionally, EO Lum reported on the Board's Fund Condition (FC) which shows a point-in-time of how much the Board has in the Board's "savings account" by fiscal year. He stated that the FC is in the black, but that it is gradually decreasing due to the cost of doing business. He added that with additional revenue coming from the new fee increases approved last year and effective July 1, 2022, the FC is projected to maintain the fund for years without needing additional revenue.

5) Administration:

Since the Board's January 22, 2022 meeting, EO Lum has participated in the following activities: several Executive level meetings with the DCA; attended the DBC's February and March 2022 meetings; participated in the recent Board President's training provided by DCA; reviewed draft regulatory language; completed many reports, risk assessment, and legislative impact reports for DCA, the Business, Consumer Services, and Housing Agency, and the Department of Finance; and continuing to oversee board operations.

Additionally, the Board's Sunset Review was postponed a year to January 1, 2024, pursuant to legislation (SB 607, Ch. 367, Statutes of 2021). In 2022, staff will be busy assembling the draft Sunset Review Report for the Board's review and approval. The Board will need to conduct an additional Board meeting in September to review and revise the draft report for finalization at the November meeting prior to submitting it to the Legislature December 1.

EO Lum provided the following 2022 Board Meeting Schedule:

- Saturday, July 23, 2022.
- Tentative: Saturday, September 24, 2022 (for Sunset Review Report)
- Saturday, November 19, 2022.

Many of these dates can change to two-day meetings if committees are needed to meet and the amount of business to be conducted. The locations and whether they'll be in-person are still to be determined, but if in-person meetings are scheduled, proof of vaccination for those individuals who haven't submitted it must be provided to DCA OHR prior to the meeting date to participate.

6) Revision of License Renewal Survey:
A request was received from CDHA to add a couple of questions of "real time" information to the voluntary License Renewal Survey to capture RDHAP data regarding their location and whether they were currently practicing dental hygiene.

At a recent DCA executive meeting, it was announced that the License Renewal Surveys would be revised so the data reported to the state's Health Care and Information Department [(HCAI), previously the Office of Statewide Health Planning and Development (OSHPD)] would be more consistent across all DCA boards. DCA informed EO Lum that the surveys could not be revised to incorporate individual program questions. However, the RDHAP and other licensee information that CDHA seeks is on EO Lum's list to obtain in the future and to report that data to the Board on a regular basis. Once the Board creates reporting templates and a method to obtain this information, it will be available and reported at Board meetings.

7) Update on Exemption Position Request (EPR).
At the November 20, 2021, Board meeting, the Board voted to submit an exempt position request (EPR) through the Department of Consumer Affairs to upgrade the executive officer's exempt level and salary. EO Lum inquired with DCA OHR for an updated status to report to the Board, but at this time, there was no update provided other than the request was forwarded to the Business, Consumer Services and Housing Agency for review. He stated that he will continue to inquire with HR about the EPR request's status and will update the Board as information is received.

Member comment: None.

Public comment: Paula Lee requested clarification regarding DHBC survey processes from EO Lum and he provided the requested clarification.

7. Update to the Full Board from the Alternative Pathways to Licensure Taskforce (Informational Only).

Dr. Carmen Dones reported that at the March 20, 2021, Board meeting, the Board voted to reconstitute the Alternative Pathways to Licensure Taskforce that had previously been assembled years before to research other pathways to licensure than the patient-based clinical examination. She stated that the taskforce is still in the beginning phases of researching the issue, as it's a very complex task to replace the clinical examination.

Dr. Dones reported that the taskforce met four times in 2021 and once in 2022, and that the most recent meeting was held on March 10, 2022, to discuss alternative options and ideas for the clinical exam. She stated that some of the issues that were discussed included:

- Alternative methods to replace the patient-based clinical examination in the interest of consumer protection.
- Need to research other state's legislation and laws to compare other jurisdictions to determine whether a clinical exam or other test was required.

- Determine whether any legislative changes to the current law need to occur prior to implementing the taskforce's recommendation.
- Collaborate and communicate with the DCA Office of Professional Examination Services for information and possible guidance regarding the clinical exam.
- Research other DCA allied health professional licensing boards to determine their licensing methods without requiring a patient-based clinical examination. Currently, the Dental Board, Dental Hygiene Board, and Hearing Aid Dispensers are the only licensing boards identified using a patient-based clinical examination for licensure.

She added that the taskforce anticipates many more meetings to come prior to providing any recommendations to the Board's Licensing Committee at a future meeting.

Member comment: Evangeline Ward questioned when the DHBC states they are one of a few licensing boards requiring a live patient exam, is the Board considering other licensing boards requirement of passing a live patient treatment process during schooling. EO Lum clarified that other licensing boards have extensive clinical rotations or live patient experiences while the prospective licensee is in school.

Public comment: Lisa Kamibayashi, Program Director of the West Los Angeles College (WLAC) Dental Hygiene Educational Program (DHEP) stated she supports permanent removal of a live patient clinical exam and suggested the Board consider requiring DHEPs to add a requirement or clinical competency for graduation to their program.

8. Update from the Central Regional Dental Testing Services (CRDTS) Regarding Member State and Steering Committee Issues (Informational Only).

Kim Laudenslager, Director of Communications and Education for the Central Regional Dental Testing Services (CRDTS) updated the Board on Member State and Steering Committee issues.

Ms. Laudenslager reported she and EO Lum have been in communication for the past nine months. She updated the Board on current CRDTS makeup and meetings, and stated the Board is active on the Dental Hygiene Exam Review Committee (ERC) and the Steering Committees. She stated the Board needs to place new Board members on those committees as the current Board members are either off the Board (Dr. Michelle Hurlbutt) or soon to be off the Board (Nicolette Moultrie). Ms. Laudenslager requested the Board to update the California representation on the CRDTS committees as soon as feasible, and offered her assistance to the Board to accomplish this goal. She stated that for the ERC, it doesn't necessarily need to be a board member, but a licensee representative.

Member comment: Nicolette Moultrie stated the ERC is an amazing group and stated that unfortunately she wasn't able to participate as much as she would have liked. She added the ERC is an important group and as the Board is looking at alternative pathways to licensure, this group would provide an excellent opportunity for those researching that subject.

Public comment: None.

9. Update from the ADEX/Western Regional Examination Board (WREB) (Informational Only).

Kimber Cobb, Director of Dental Hygiene Examinations for Commission on Dental Competency Assessment/Western Regional Examining Board (CDCA-WREB) reported on August 3, 2021, CDCA and WREB merged and that the WREB examination will be offered in 2022. However, she reported that beginning in 2023, ADEX will be the only examination that will be offered by CDCA-WREB.

Ms. Cobb reported that ADEX examination provides consistent quality administration of dental hygiene licensure examinations throughout the country and that additional assessments can be developed upon request from the Board.

Ms. Cobb provided an overview of the examination construction and administration of the ADEX exams for the patient-based examination and the simulated patient examinations. Additionally, she reported the ADEX patient-based examinations are accepted by 47 states as well as that 40 states accept the ADEX simulated patient examinations with more states pending.

Additionally, Ms. Cobb provided an overview on the 2022 Dental Hygiene Computer Simulated Clinical Exam (CSCE) Objective Structured Clinical Evaluation (OSCE), along with pass rate statistics for patient-based examinations, simulated patient examinations, and the CSCE OSCE.

Member comment: Discussion took place regarding WREB and ADEX examinations offered by CDCA-WREB and representation by member states.

Public comment: None.

10. Discussion and Possible Action to Extend the Temporary Acceptance of the Manikin-Based Dental Hygiene Clinical Examinations Administered by ADEX/WREB and CRDTS.

EO Lum reported that at the August 29, 2020, Board meeting, the Board voted to temporarily accept the manikin-based clinical examinations administered by ADEX/WREB and CRDTS due to the COVID environment. He stated the temporary acceptance of this examination was extended twice (at the March 6, 2021, Board meeting and the July 17, 2021, Board meeting) to now expire on July 1, 2022.

EO Lum stated that due to the continued COVID-19 environment, continued hesitation for unnecessary large gatherings, and the fact that there are some ethical issues associated with the live patient-based clinical examinations like payment for patient participation, he stated that staff recommends for the Board to extend the deadline to temporarily accept the

alternative manikin-based dental hygiene clinical examination, in addition to the patient-based examination administered by ADEX/WREB and CRDTS, until December 31, 2022.

Motion: Nicolette Moultrie moved for the Board to extend the temporary acceptance of the alternative manikin-based clinical examinations administered by ADEX/WREB and CRDTS, as well as the patient-based examinations by the same exam administrators, until December 31, 2022, based upon the current COVID-19 environment.

Second: Garry Shay

Member discussion: Discussion took place regarding the extension of the temporary acceptance of manikin-based dental hygiene clinical examinations administered by ADEX/WREB and CRDTS.

Public comment:

Lisa Kamibayashi, WLAC DHEP Program Director, requested for the Board to extend the temporary acceptance of manikin-based dental hygiene clinical examinations until June 30, 2023, to allow for dental hygiene programs to plan for future student exam preparation.

Paula Lee, CDHA GRC Representative, stated in respect to permanent extension of acceptance of the manikin exams, she stated with DHEPs focusing on live patient experiences for one and one-half years, this would cover live-patient experiences and therefore, the manikin exam would be fair and allow for portability of exam for licensure.

Nancy Cheung, Chabot College DHEP Program Director, thanked the taskforce for exploring alternative pathways to licensure, and echoed Lisa Kamibayashi's comments.

Vote: Motion for the Board to extend the temporary acceptance of the alternative manikin-based clinical examinations administered by ADEX/WREB and CRDTS, as well as the patient-based examinations by the same exam administrators, until December 31, 2022, based upon the current COVID-19 environment. Passed 8:0:1.

Name	Aye	Nay	Abstain/Absent
Denise Davis	X		
Carmen Dones	X		
Susan Good	X		
Noel Kelsch			X Absent
Timothy Martinez	X		
Nicolette Moultrie	X		
Garry Shay	X		
Evangeline Ward	X		

Name	Aye	Nay	Abstain/Absent
Erin Yee	X		

11. Update on the Annual Report from the Attorney General's Office (Informational Only).

Carl Sonne, Senior Assistant Attorney General of the Licensing Section of the Office of the Attorney General (AG), reported the Licensing Section is in charge of enforcement activities of the Board. Mr. Sonne provided a background on Business and Professions Code Section 312.2 and presented information on how data is collected in the Attorney General's Annual Report on Accusations Prosecuted for Department of Consumer Affairs Client Agencies (January 1, 2022) provided to the Board.

Additionally, Mr. Sonne focused on accusation matters referred to the AG by the Board and complemented the Board on their robust system, along with their thoroughness and professionalism when presenting the Board's cases.

Member comment: None.

Public comment: None.

12. Regulatory Update: Status of Dental Hygiene Board of California Regulatory Packages (Informational Only).

Dr. Adina Petty reported the current status as to DHBC proposed regulatory packages completed and in process for the Board. Additionally, she provided an overview of the regulatory process.

Member discussion: Discussion took place regarding the current status as to DHBC proposed regulatory packages completed and in process for the Board

Public comment: None.

13. Discussion and Possible Action to Amend Title 16 (16), California Code of Regulations (CCR) Section 1104.1, Process for Approval of a New RDH Educational Program.

Dr. Adina Petty reported that Senate Bill (SB) 534 (Jones, Chapter 491, Statutes of 2021) authorizes the Board to require a new educational program for registered dental hygienists in alternative practice (RDHAPs) or registered dental hygienists in extended functions (RDHEFs) to submit a feasibility study demonstrating a need for a new educational program and to apply for approval from the Board before seeking approval for initial accreditation from the Commission on Dental Accreditation or an equivalent body, as determined by the Board. She stated that staff drafted proposed amended language and

associated form in the attached documents to address the statutory requirements of SB 534.

Dr. Petty stated that staff recommends for the Board review the proposed amended language and associated form, determine whether additional information or language is required, complete the draft of the proposed regulatory language and associated form, and direct staff to initiate the rulemaking process

Motion: Nicolette Moultrie moved for the Board to approve the proposed amended language and associated form for section 1104.1 and direct staff to submit the language to the Director of the Department of Consumer Affairs and the Business, Consumer Services, and Housing Agency for review, and if no adverse comments are received, authorize the Executive Officer to take all steps necessary to initiate the rulemaking process, make any non-substantive changes to the package, and set the matter for a hearing if requested. If no adverse comments are received during the 45-day comment period and no hearing is requested, authorize the Executive Officer to take all steps necessary to complete the rulemaking and adopt the proposed regulation at Section 1104.1 as noticed.

Second: Garry Shay.

Member discussion: None.

Public comment: None.

Vote: Motion for the Board to approve the proposed amended language and associated form for section 1104.1 and direct staff to submit the language to the Director of the Department of Consumer Affairs and the Business, Consumer Services, and Housing Agency for review, and if no adverse comments are received, authorize the Executive Officer to take all steps necessary to initiate the rulemaking process, make any non-substantive changes to the package, and set the matter for a hearing if requested. If no adverse comments are received during the 45-day comment period and no hearing is requested, authorize the Executive Officer to take all steps necessary to complete the rulemaking and adopt the proposed regulation at Section 1104.1 as noticed. Passed 8:0:1.

Name	Aye	Nay	Abstain/Absent
Denise Davis	X		
Carmen Dones	X		
Susan Good	X		
Noel Kelsch			X Absent
Timothy Martinez	X		
Nicolette Moultrie	X		

Name	Aye	Nay	Abstain/Absent
Garry Shay	X		
Evangeline Ward	X		
Erin Yee	X		

14. Discussion and Possible Action to Amend Title 16, Section 1115, Retired Licensure.

Dr. Adina Petty reported that at the January 22, 2022, Full Board WebEx Teleconference (January teleconference), the Board approved proposed language and responses to the 45-day comment period for the implementation of California Code of Regulations (CCR), Title 16, Division 11 section 1115 regarding Retired Licensure (section 1115), and directed staff to take all steps necessary to complete the rulemaking process. This included sending out the modified text with these changes for an additional 15-day comment period, and authorizing the Executive Officer to make any non-substantive changes to the proposed regulation and adopt the proposed regulation as described in the modified text notice for section 1115.

Dr. Petty stated that during her review, Kimberly Kirchmeyer, Director of the Department of Consumer Affairs, suggested clarifications to the forms to prevent duplication and provide consistency among forms utilized by the Board. She stated that staff recommends for the Board to consider and approve the proposed modified forms and direct staff to take all steps necessary to complete the rulemaking process, including authorizing the Executive Officer to make any non-substantive changes to the proposed regulation, and adopt the proposed regulation at section 1115.

Motion: Evangeline Ward moved to approve the proposed modified forms for section 1115 and direct staff to take all steps necessary to complete the rulemaking process, authorize the Executive Officer to make any non-substantive changes to the proposed regulation, and adopt the proposed regulation as described in the modified text notice for section 1115.

Second: Garry Shay.

Member discussion: Discussion took place regarding the proposed modified forms for section 1115, Retired Licensure.

Public comment: None.

Vote: Motion for the Board to approve the proposed modified forms for section 1115 and direct staff to take all steps necessary to complete the rulemaking process, authorize the Executive Officer to make any non-substantive changes to the proposed regulation, and adopt the proposed regulation as described in the modified text notice for section 1115. Passed 7:1:1.

Name	Aye	Nay	Abstain/Absent
Denise Davis	X		
Carmen Dones	X		
Susan Good	X		
Noel Kelsch			X Absent
Timothy Martinez	X		
Nicolette Moultrie		X	
Garry Shay	X		
Evangeline Ward	X		
Erin Yee	X		

15. Discussion and Possible Action to Amend Title 16, Section 1138.1, Unprofessional Conduct.

Dr. Adina Petty reported that on November 21, 2020, the Board discussed, amended, and voted unanimously to approve proposed regulatory package: California Code of Regulations (CCR) Title 16 (16), section 1138.1, Unprofessional Conduct.

She stated that on January 26, 2022, the Board received comments from the Office of Administrative Law (OAL) on the Board's proposed regulations for 16 CCR section 1138.1, which necessitated substantive changes that require the Board's approval. Dr. Petty reported that on January 27, 2022, the Board withdrew proposed section 1138.1 from OAL review, and prepared a modified text and an Addendum to the Initial Statement of Reasons (ISOR) for a 15-day comment period, which includes amendments proposed by OAL. The modified text and Addendum to ISOR was noticed to stakeholders on February 23, 2022, with a comment period to end on March 11, 2022. She stated that staff requests for the Board to consider and approve the substantive amendments as proposed by OAL for section 1138.1 to allow section 1138.1 to move forward in the regulatory process.

Motion: Nicolette Moultrie moved for the Board direct staff to submit the text to the Director of the Department of Consumer Affairs and the Business, Consumer Services, and Housing Agency for review and if no adverse comments are received, authorize the Executive Officer to take all steps necessary to continue the rulemaking process, make any non-substantive changes to the package, and set the matter for a hearing if requested. If no adverse comments are received during the 15-day comment period and no hearing is requested, authorize the Executive Officer to take all steps necessary to complete the rulemaking and adopt the proposed regulations at Section 1138.1 as noticed.

Second: Susan Good.

Member discussion: None.

Public comment: None.

Vote: Motion for the Board to direct staff to submit the text to the Director of the Department of Consumer Affairs and the Business, Consumer Services, and Housing Agency for review and if no adverse comments are received, authorize the Executive Officer to take all steps necessary to continue the rulemaking process, make any non-substantive changes to the package, and set the matter for a hearing if requested. If no adverse comments are received during the 15-day comment period and no hearing is requested, authorize the Executive Officer to take all steps necessary to complete the rulemaking and adopt the proposed regulations at Section 1138.1 as noticed. Passed 8:0:1.

Name	Aye	Nay	Abstain/Absent
Denise Davis	X		
Carmen Dones	X		
Susan Good	X		
Noel Kelsch			X Absent
Timothy Martinez	X		
Nicolette Moultrie	X		
Garry Shay	X		
Evangeline Ward	X		
Erin Yee	X		

16. Update on Current Legislation.

Dr. Adina Petty reported the proposed legislative packages currently in progress of concern for the Board which included:

Legislation	DHBC Position as of 3.19.22
Assembly Bill (AB) 646 (Low): Department of Consumer Affairs: boards: expunged convictions.	Watch.
AB 858 (Jones-Sawyer): Employment: health information technology: clinical practice guidelines: worker rights.	Watch.
AB 1604 (Holden): The Upward Mobility Act of 2022: boards and commissions: civil service: examinations: classifications.	Watch.

Legislation	DHBC Position as of 3.19.22
AB 1662 (Gipson): Licensing boards: disqualification from licensure: criminal conviction.	Oppose.
AB 1733 (Quirk): State bodies: Open meetings.	Support.
AB 1982 (Santiago): Telehealth: dental care.	Watch.
AB 2104 (Flora): Professions and vocations.	Oppose.
AB 2145 (Davies): Dental services: skilled nursing facilities and intermediate care facilities/developmentally disabled.	Support.
AB 2600 (Megan Dahle): State agencies: letters and notices: requirements.	Watch.
Senate Bill (SB) 652 (Bates): Dentistry: use of sedation: training.	Watch.
SB 889 (Ochoa Bogh): Nurse anesthetists.	Watch.
SB 1031 (Ochoa Bogh): Healing arts boards: inactive license fees.	Oppose.
SB 1237 (Newman): Licenses: military service.	Watch.
SB 1365 (Jones): Licensing boards: procedures.	Oppose.
SB 1443 (Roth): The Department of Consumer Affairs.	Watch.
SB 1471 (Archuleta): Dentistry: foreign dental schools.	Watch.

Motion: Garry Shay moved for the Board to approve the Board's positions as recommended by staff.

Second: Nicolette Moultrie.

Member discussion: Discussion took place regarding the Board's positions on AB 646, AB 858, AB 1604, AB 1662, AB 1773, AB 1982, AB 2104, AB 2145, AB 2600, SB 652, SB 889, SB 1031, SB 1237, SB 1365, SB 1443, and SB 1471.

Public comment: None.

Vote: Motion for the Board to approve the Board's positions as recommended by staff. Passed 6:0:3.

Name	Aye	Nay	Abstain/Absent
Denise Davis			X Absent
Carmen Dones	X		
Susan Good			X Absent
Noel Kelsch			X Absent
Timothy Martinez	X		
Nicolette Moultrie	X		
Garry Shay	X		
Evangeline Ward	X		
Erin Yee	X		

17. Education Update.

Dr. Adina Petty reported the current status of Dental Hygiene Educational Program (DHEP) compliance at Concorde Career College – San Diego, Chabot College, Southwestern College, Oxnard College, and Concorde Career College – Garden Grove. Additionally, she provided the Board the current Site Visit schedule for upcoming program reviews.

Member discussion: None.

Public comment: Nancy Cheung, Chabot College DHEP Director, thanked Board staff for being supportive and making the Board's site visit at her school seamless.

18. Enforcement Update: Statistical Report (Informational Only).

Assistant Executive Officer (AEO) Elizabeth Elias reported the Enforcement Unit has one vacant position, an Enforcement Analyst, and stated management is working on the recruitment at this time. She stated Enforcement staff are on an office-centric telework schedule, which requires them to be in the office 3 days a week and telework 2 days a week. AEO Elias indicated that since COVID-19 began, staff have been flexible and have adapted to new business processes that have been established. She stated staff use new technology such as Microsoft Teams and WebEx for meetings, training, and communication. She reported that in addition, new processes have been established to transmit files and other documents in a secure method to expert witnesses and the Attorney General's Office.

AEO Elias reported management routinely assigns training courses for continued staff development, and that recently, all enforcement staff completed the Skilled Enhancement

Training (SET) instructed by the DCA's SOLID Unit. She stated SET is an 8-week (1 day/week) program where staff learn about collaboration, communication, customer engagement, digital fluency, diversity & inclusion, innovative mindset, resilience, and interpersonal skills.

AEO Elias reported that as time allows, enforcement staff continue to work on several major projects including revising disciplinary guidelines, updates to desk manuals, and creating content for an enforcement section to the Board's website. She stated that recently, staff finalized identifying additional BreEZe codes that will help with monitoring cases and workload and stated the updates should be within in the next BreEZe release.

AEO Elias provided detailed statistics regarding complaints received and investigations performed by the DHBC. Additionally, she indicated DCA established a transparent set of measurements to track the department's effectiveness at managing the consumer complaint process. Enforcement Performance Measures (EPMs) which are updated each quarter, can be found online, and provided the link to the information (https://www.dca.ca.gov/data/enforcement_performance.shtml).

Member discussion: None.

Public comment: None.

19. Licensing, Continuing Education Audits and Examination Update: Statistical Reports (Informational Only).

a. Licensing Update

AEO Elizabeth Elias reported the Licensing Unit is fully staffed and that beginning in Fiscal Year (FY) 2021/2022, DCA began reporting Licensing Performance Measures (LPM) data on a quarterly basis for all active DCA entities. LPM data is interactive and includes data for complete, incomplete and renewal application types. She stated that LPM data can be found by clicking on the Quarterly Licensing Data button on the Board's website www.dhbc.ca.gov.

b. Continuing Education Update

AEO Elias reported that the Board is on track to surpass the number of audits completed in FY 2020/21. In FY 2021/22 the Board initiated 474 Continuing Education (CE) audits. She stated the Board continues to see similar trends in the pass and fail rate. She stated the Board receives many reasons for failure to comply with the CE Audit (e.g., licensees reporting they misplaced, destroyed, or lost their records). AEO Elias stated staff would like to remind licensees that pursuant to Title 16 CCR section 1017(m), licensees shall retain for a period of three renewal cycles (6 years) the certificates of course completion issued to them and shall forward to them to the Board only upon request by the Board for an audit. She stated a licensee who fails to retain a certification should contact the CE provider and obtain a duplicate certification.

AEO Elias reported that failed audits are broken into two categories, no response and insufficient CEUs. Of those with insufficient CEUs, she stated 60% failed to complete at least one mandatory CEU and 18% submitted a certificate with an invalid provider. She stated the reasons for the invalid provider may have been due to an expired permit, not being approved to teach a mandatory CE course, or may have had an invalid Dental Board of California CE provider number.

AEO Elias reported that the Board's Enforcement Unit is working through a backlog of failed audits and issuing citation and fines with or without an order of abatement to address the CE deficiencies. She stated that for failed CE audits, the Board issued citations in varying amounts ranging from $500 - $1,500 depending on the egregiousness of the failed audit. AEO Elias stated that when issuing a citation, the Board considers many factors including, but not limited to: 1) How many CEUs is the licensee deficient; 2) The licensee's reason for failing the audit; and 3) If the licensee completed mandatory CEUs in Infection Control, Dental Practice Act, and Basic Life Support. Additionally, as with any citation that is issued, the Board uses Title 16, CCR section 1140 "Criteria to be Considered" when issuing a citation.

AEO Elias stated that the CE section of the Board's website (www.dhbc.ca.gov) has been revised and that the updates will be available to the public by the end of the month.

Member discussion: Evangeline Ward thanked staff for the clear and detailed way the statistics were presented for Agenda Items 18 and 19 in comparison to how they were reported in the past.

Public comment: None.

20. Future Agenda Items.

1. Dr. Martinez: Regarding patients that are special needs, wanted to know if the Board can discuss the ways the Board can help facilitate care to this population and collaboration among the dental care providers.
2. President Dones:
    a. ADEX and WREB present a fiscal analysis and data comparison of manikin vs. live patient examinations.
    b. Discussion on permanent acceptance of manikin clinical exams.
    c. An additional Board meeting addressing the Board's position on AB 2276.

3. JoAnn Galliano supported President Dones's request for the Board to conduct an additional meeting to address the Board's position on AB 2276 prior to the July 2022 Board meeting.

4. Norina Del Rosario (requested the Board to consider changing the supervision requirements over soft tissue curettage, local anesthesia, and nitrous oxide-oxygen analgesia from direct supervision from a licensed dentist to general supervision.

21. Closed Session – None.

22. Adjournment

Meeting was adjourned at **1:32 p.m.**

MEMORANDUM

DATE	April 23, 2022
TO	Dental Hygiene Board of California
FROM	Adina A. Pineschi-Petty DDS Education, Legislative, and Regulatory Specialist
SUBJECT	**FULL 4: Discussion and Possible Action on Assembly Bill 2276 Carrillo - Dental Assistants.**

BACKGROUND

On February 16, 2022, Assembly Member Wendy Carrillo introduced Assembly Bill (AB) 2276 to add Section 1750.11 to the Business and Professions Code (BPC) relating to dental assistants.

AB 2276 would authorize unlicensed dental assistants (DAs) to polish the coronal surfaces of teeth or apply pit and fissure sealants under the direct supervision of a licensed dentist when the dental assistant has completed specified training and provided evidence of the completion of that training to the Dental Board of California (DBC). DAs obtain their experience from on-the-job training rather than the completion of a formal educational program.

The reason for this legislative proposal is two-fold. First, the California Dental Association (CDA) has indicated that there's a dental assistant shortage nationwide and dental practices are experiencing difficulties in hiring DAs for their offices. No information or data was provided specific to California, so it's unknown whether there's a shortage in this state. Second, according to CDA, the expansion of DA duties will assist to draw more individuals to the dental field and alleviate the shortage in this area. There are already two pathways in existence that allows individuals to become dental assistants through a formal dental assistant program at an educational institution where they can be registered or through an on-the-job training pathway where individuals work a certain number of hours under a supervising dentist and complete coursework to become dental assistants. By expanding the DA's scope allowing them to provide coronal polishing and pit and fissure sealants, it's difficult to envision that the expanse into these services will attract more people to the profession.

Historically, polishing the coronal surfaces of teeth or applying pit and fissure sealants has been a duty assigned to licensed registered dental hygienists (RDHs) and licensed registered dental assistants (RDAs) (after additional training in those duties beyond their RDA education) due to the necessary and extensive formal education required prior to providing these services to the public. With the legislative proposal infringing on the RDH's scope of practice and placing the consumer at risk by having unlicensed DAs provide these potentially irreversible dental services, the Board should oppose this bill, unless amended, for the following reasons:

1. CDA is basing the dental assistant (DA) shortage on national DA information according to their unofficial fact sheet, but no information was presented specifically for California (CA), so there may not be a current DA shortage in CA.
2. The procedures to expand the DA's scope (coronal polishing and pit and fissure sealants) may be irreversible or could cause tissue damage leading to other health issues if done incorrectly since the dentist is not next to the DA while performing these services. With an unlicensed and under educated person treating patients, it's a great risk to the consumer for DAs to provide these services.
3. There's no board oversight of DAs which compromises consumer protection since they're unlicensed and obtain on-the-job training from the dentist. The bill says that the supervising dentist and dental practice will be responsible for determining the competency of the DA. Does this mean that the supervising dentist is also responsible for the DA and if patient harm is committed, have action taken against the dentist's license or dental practice?
4. The term **"Direct Supervision"** could be misleading to the public. The DPA's definition for direct supervision is:" The supervision of dental procedures based on instructions given by a licensed dentist who is required to be physically present in the treatment facility during the performance of those procedures." They (the dentist) must be present in the facility, but direct supervision doesn't mean that the dentist will be right beside the unlicensed DA performing the dental services detailed in the bill. The dentist can be away treating another patient or in their office while the DA provides the dental services treating patients as long as the dentist is in the facility and checks the DA's work prior to the patient leaving.
5. By allowing unlicensed DAs to perform these duties, it infringes on the existing scope of practice and law for Registered Dental Hygienists and Registered Dental Assistants who have also completed formal education in their respective professions and biomedical science coursework to support their knowledge and potential consequences of the dental services they provide.

STAFF RECOMMENDATION:

Staff recommends for the Board to oppose, unless amended, AB 2276 and send a letter of opposition with its reasons to Assembly Member Wendy Carrillo and the Legislature.

PROPOSED MOTION LANGUAGE:

I move for the Board to approve the Board's position and send a letter of opposition, unless amended, with its reasons to Assembly Member Wendy Carrillo regarding Assembly Bill 2276 – Dental Assistants.

Documents Included for Reference for AB 2276:

1. AB 2276 language.
2. AB 2276 Assembly Committee on Business and Professions Analysis.
3. AB 2276 California Dental Association Fact Sheet.

4. California Dental Hygienists' Association (CDHA) Opposition Letter.
5. The California Dental Assisting Alliance (CDAA) Opposition Letter.
6. "Minimal Intervention Polishing Enamel – Part 7 of 10", August 1, 2008. https://www.rdhmag.com/patient-care/rinses-pastes/article/16408036/minimal-intervention
7. "Whether they need it ...or not!", Nov. 1, 2001. https://www.rdhmag.com/patient-care/rinses-pastes/article/16404356/whether-they-need-it-or-not
8. "Focus on Prophy Pastes and Air Polishing Powders: The Wide Selection of Prophy Pastes and Air Polishing Powders Gives Dental Hygienists the Ability to Personalize Treatment for Every Patient." Dimensions of Dental Hygiene, June 2015, p.38-40.
9. "Microleakage of pit and fissure sealings placed after enamel conditioning with phosphoric acid or with self-etching primers/adhesives" by Amend et al., April 7, 2021. Clinical and Experimental Dental Research/Volume 7, Issue 5/ p. 763-771. https://onlinelibrary.wiley.com/toc/20574347/2021/7/5
10. "Effect of Etching Time and Acid Concentration on Micromorphological Changes in Dentin of Both Dentitions", Gateva et al., Journal of the International Medical Association of Bulgaria, 2016, Vol.22, Issue 2. http://dx.doi.org/10.5272/jimab.2016222.1099
11. "Quick Answer: How Much Phosphoric Acid Is in Coke" https://www.seniorcare2share.com/how-much-phosphoric-acid-is-in-coke/
12. **"Direct Supervision"** definition pursuant to Title 16, California Code of Regulations section 1067(i) – the supervision of dental procedures based on instructions given by a licensed dentist who is required to be physically present in the treatment facility during the performance of those procedures.

ASSEMBLY BILL No. 2276

Introduced by Assembly Member Carrillo

February 16, 2022

An act to add Section 1750.11 to the Business and Professions Code, relating to healing arts.

LEGISLATIVE COUNSEL'S DIGEST

AB 2276, as introduced, Carrillo. Dental assistants.

Existing law, the Dental Practice Act, establishes a Dental Assisting Council of the Dental Board of California to regulate the examination, licensure, and permitting of dental assistants. Existing law authorizes a dental assistant to perform basic supportive dental procedures, including the application of topical fluoride under the direct supervision of a supervising licensed dentist.

This bill would additionally authorize dental assistants to polish the coronal surfaces of teeth or apply pit and fissure sealants under the direct supervision of a licensed dentist when the dental assistant has completed specified training and provided evidence of the completion of that training to the board.

Vote: majority. Appropriation: no. Fiscal committee: yes. State-mandated local program: no.

The people of the State of California do enact as follows:

SECTION 1. Section 1750.11 is added to the Business and Professions Code, to read:

1750.11. (a) A dental assistant may polish the coronal surfaces of teeth or apply pit and fissure sealants when the dental assistant has completed each of the following:

(1) A board-approved, two-hour course in the Dental Practice Act.

(2) A board-approved, eight-hour course in infection control.

(3) Any board-approved course in the procedure they seek to perform.

(b) The procedure shall be performed under the direct supervision of a licensed dentist.

(c) The procedure shall be performed only after the dental assistant has provided evidence to the board they have completed a board-approved course in the procedure.

O

Date of Hearing: April 5, 2022

ASSEMBLY COMMITTEE ON BUSINESS AND PROFESSIONS
Marc Berman, Chair
AB 2276 (Carrillo) – As Introduced February 16, 2022

SUBJECT: Dental assistants.

SUMMARY: Authorizes unlicensed dental assistants to polish teeth and apply dental sealants.

EXISTING LAW:

1) Regulates the practice of dentistry under the Dental Practice Act and establishes the Dental Board of California (DBC) within the Department of Consumer Affairs (DCA) to administer and enforce the act. (Business and Professions Code (BPC) §§ 1600-1976)

2) Requires every board in the DCA to require its licensees to provide notice to their clients or customers that the practitioner is licensed by this state. (BPC § 138)

3) Requires the DBC to require (1) that the required notice regarding state licensure includes a provision that the DBC is the entity that regulates dentists and dental assistants and provides the telephone number and website of the DBC and (2) that the notice to be posted in a conspicuous location accessible to public view and accessible electronically for patients receiving dental services through telehealth. (BPC § 1611.3)

4) Authorizes the DBC to inspect the licensing documents, records, and premises of any dental assistant permitted under the Dental Practice Act in response to a complaint that a dental assistant has violated any law or regulation that constitutes grounds for disciplinary action by the DBC. (BPC § 1611.5)

5) Requires the DBC to keep a record of the names of all persons to whom licenses or permits have been granted by it to practice dentistry, dental assisting, or any other function requiring a permit, and other records as may be necessary to show plainly all of its acts and proceedings. (BPC § 1612)

6) Defines "direct supervision" to mean the supervision of dental procedures based on instructions given by a licensed dentist, who must be physically present in the treatment facility during the performance of those procedures. (BPC § 1741(b))

7) Defines "general supervision" as supervision of dental procedures based on instructions given by a licensed dentist but not requiring the physical presence of the supervising dentist during the performance of those procedures. (BPC § 1741(c))

8) Defines a "dental assistant" as an individual who, without a license, may perform basic supportive dental procedures, as defined, under the supervision of a licensed dentist. (BPC § 1750(a))

9) Defines "basic supportive dental procedures" as procedures that have technically elementary characteristics, are completely reversible, and are unlikely to precipitate potentially hazardous conditions for the patient being treated. (BPC § 1750(a))

10) Specifies that the supervising licensed dentist is responsible for determining the competency of a dental assistant to perform any basic supportive dental procedures. (BPC § 1750(b))

11) Specifies that the employer of a dental assistant is responsible for ensuring that a dental assistant who has been in continuous employment for 120 days or more, has already completed, or completes, all of the following within a year of the date of employment:

    a) A DBC-approved two-hour course about the Dental Practice Act. (BPC § 1750(c)(1))

    b) A DBC-approved eight-hour course in infection control. (BPC § 1750(c)(2))

    c) A course in basic life support offered by an instructor approved by the American Red Cross or the American Heart Association, or any other equivalent course approved by the DBC that provides the student the opportunity to engage in hands-on simulated clinical scenarios. (BPC § 1750(c)(3))

12) Authorizes a dental assistant to perform various procedures under the direct supervision of a licensed dentist, including the application of specified topical agents, placing and removing orthodontic separators, examining and seating removable orthodontic appliances, removing post-extraction dressings, and removing sutures, among others. (BPC 1750.1(b))

13) Specifies that unprofessional conduct includes the aiding or abetting of a dental assistant to practice dentistry in a negligent or incompetent manner. (BPC § 1680(y))

THIS BILL:

1) Authorizes a dental assistant to polish the coronal surfaces of teeth or apply pit and fissure sealants when the dental assistant has completed each of the following:

    a) A DBC-approved, two-hour course about the Dental Practice Act.

    b) A DBC-approved, eight-hour course in infection control.

    c) A DBC-approved course in the procedure they seek to perform.

2) Requires the procedure to be performed under the direct supervision of a licensed dentist.

3) Requires the procedure to be performed only after the dental assistant has provided evidence to the DBC they have completed a DBC-approved course in the procedure.

FISCAL EFFECT: Unknown. This bill is keyed fiscal by the Legislative Counsel.

COMMENTS:

Purpose. This bill is sponsored by the *California Dental Association*. According to the author, "[This bill] would expand the scope of work for dental assistants that have completed a course on the respective procedure and a course on infection control to perform coronal polishing and apply sealants. By making this narrow change, this bill will create more opportunities for recruiting and hiring Dental Assistants. The American Dental Association has identified a workforce need for Dental Assistants, with a 50% decline in the number of first year enrollments in training programs over the last ten years. This bill also preserves existing standards of patient

care, by requiring the supervision of a licensed dentist and only allowing procedures that are fully reversible."

Background. Dental assistants are unlicensed individuals who work in dental practices under the supervision of a licensed dentist and perform specified "basic supportive dental procedures," which are defined as "procedures that have technically elementary characteristics, are completely reversible, and are unlikely to precipitate potentially hazardous conditions for the patient being treated." Because dental assistants are unlicensed they are not registered with the DBC or directly regulated by the DBC.

Scope of Practice. Under the general supervision of a licensed dentist, meaning the dentist provides direction and is responsible for the actions of the dental assistant but does not have to be physically present, a dental assistant may perform the following:

1) Extra-oral duties or procedures specified by the supervising licensed dentist, provided that the duties or procedures meet the definition of a "basic supportive dental procedure."

2) Operate dental radiography equipment for oral radiography if the dental assistant has complied with additional radiography requirements.

3) Perform intraoral and extraoral photography.

Under the direct supervision of a licensed dentist, meaning the dentist provides direction and is physically on the premises and available, a dental assistant may perform the following:

1) Apply nonaerosol and noncaustic topical agents.

2) Apply topical fluoride.

3) Take intraoral impressions for all nonprosthodontic appliances.

4) Take facebow transfers and bite registrations.

5) Place and remove rubber dams or other isolation devices.

6) Place, wedge, and remove matrices for restorative procedures.

7) Remove postextraction dressings after inspection of the surgical site by the supervising licensed dentist.

8) Perform measurements for orthodontic treatment.

9) Cure restorative or orthodontic materials in an operative site with a light-curing device.

10) Examine orthodontic appliances.

11) Place and remove orthodontic separators.

12) Remove ligature ties and archwires.

13) After adjustment by the dentist, examine and seat removable orthodontic appliances and deliver care instructions to the patient.

14) Remove periodontal dressings.

15) Remove sutures after inspection of the site by the dentist.

16) Place patient monitoring sensors.

17) Monitor patient sedation, limited to reading and transmitting information from the monitor display during the intraoperative phase of surgery for electrocardiogram waveform, carbon dioxide and end-tidal carbon dioxide concentrations, respiratory cycle data, continuous noninvasive blood pressure data, or pulse arterial oxygen saturation measurements, for interpretation and evaluation by a supervising licensed dentist who is at the patient's chairside during this procedure.

18) Assist in the administration of nitrous oxide when used for analgesia or sedation, except they may not start the administration of the gases or adjust the flow of the gases unless instructed to do so by the supervising licensed dentist present at the patient's chairside.

This bill would additionally allow a dental assistant under direct supervision to perform polishing of the coronal surfaces of the teeth and apply pit and fissure sealant. Currently, Registered Dental Assistants (RDAs) and Registered Dental Hygenists (RDHs) are the only non-dentists who may polish teeth and apply sealants (besides a dentist). Both professions are licensed and have significantly more training than a dental assistant.

Training. Dental assistants have minimal training requirements. Within one year of employment, dental assistants must complete the following:

1) A DBC-approved two-hour course in the Dental Practice Act.

2) A DBC-approved eight-hour course in infection control.

3) A course in basic life support offered by an instructor approved by the American Red Cross or the American Heart Association, or other equivalent course approved by the DBC.

In addition, dental assistants must practice under supervision, and the supervising dentist is responsible for determining the competency of the dental assistant to perform the basic supportive dental procedures. If the dentist allows the dental assistant to practice incompetently, the dentist is subject to disciplinary action by the DBC, up to revocation of their license.

Dental assistants may also perform additional procedures if they obtain additional training in orthodontics and sedation. The additional training requirements include 12 months of work experience as a dental assistant and completion of a DBC-approved course for the relevant topic after at least 6 months of work as a dental assistant.

This bill would additionally require dental assistants to complete DBC-approved courses in tooth polishing and application of pit and fissure sealant and submission of proof of completion to the DBC to perform the procedures authorized under this bill.

Coronal Polishing. Coronal (towards the crown of the tooth) polishing is a procedure that removes plaque and stains from exposed tooth surfaces, utilizing a rotary instrument with a rubber cup or brush and a polishing agent. The goals of polishing are to clean and create a smooth tooth surface that is less likely to stain, retain buildup, enhance fluoride absorption, and prepare teeth for other dental procedures.

To accomplish that goal, abrasive polishing agents are used to both remove material that has adhered to the surface of a tooth and smooth the surface of the teeth. Smoothing is accomplished by causing microabrasions that eventually even out larger scratches and other features that cause roughness.

Pit and Fissure Sealant. The application of sealant to teeth is a procedure that creates a physical barrier and is commonly used for pits and fissures. Pits and fissures are more prone to cavities and the enamel in pits and fissures does not benefit as well as smooth surfaces from fluorides.

The process for applying sealant starts with cleaning the areas to be sealed and then using acidic substances to create an acid etch, which is a rough patch at the microscopic level in the enamel of the teeth. The etch helps the sealant bond with the tooth.

Other States. Many states require additional training for an unlicensed dental assistant to provide these procedures, some requiring the equivalent of an RDA in California and some requiring training similar to this bill or additional supervision limitations. There are also at least three states that prohibit any type of dental assistant, licensed or otherwise, from performing the procedures under this bill. Four states are completely silent on polishing and two states are silent on sealants.

ARGUMENTS IN SUPPORT:

The *California Dental Association (sponsor)* writes in support:

> Dentistry, like many other professions, was hit hard by the onset of COVID-19. This unprecedented public health emergency led to approximately 97% of dental offices closing completely during the initial months of the 2020 shelter-in-place orders. Even though dental offices are operating at a capacity near pre-pandemic levels, preexisting workforce shortages, particularly dental assistant (DA) positions, have been exacerbated by the pandemic.
>
> In November 2021, 87% of dental offices nationally reported that when compared to pre-pandemic, it is extremely challenging to recruit and hire dental assistants. In the same survey, 44% of providers identified trouble filling vacant staff positions have limited their practice's ability to treat more patients. Lastly, according to the American Dental Association, over the last 10 years there has been a nearly 50% decline in the number of first-year enrollment in dental assistant programs.
>
> Dental assistants are often trained on the job and play a vital role in supporting the entire dental team. Currently, dental assistants can enroll and complete courses to receive certificates through programs approved by the [DBC] to perform coronal polishing and apply sealants, but they cannot perform these tasks until [they] receive [RDA] licensure.

> [This bill] would expand the scope of practice of unlicensed dental assistants to include coronal polishing and placement of sealants under direct supervision once they have successfully obtained the appropriate certifications. This bill will help alleviate some of the dental assisting workforce issues that dental practices throughout California have been facing in three primary ways. First, this bill allows unlicensed dental assistants to perform duties to the limits of their certifications without needing to complete a costly RDA program and exam. Second, this bill provides DAs additional opportunities to learn about the dental assisting career ladder. Lastly, this bill balances the needs of dental practices who are struggling to hire dental team members that expand the ability to provide care while also protecting patients by ensuring DAs are appropriately trained and supervised to perform these new duties.

ARGUMENTS IN OPPOSITION:

The *California Dental Assisting Alliance*, which includes the *California Association of Dental Assisting Teachers*, *California Dental Assistants Association*, *Dental Assisting Educators Group*, and *RDAEF Association*, writes in opposition:

> The California Dental Association is seeking a statutory change to have an unlicensed dental assistant perform more advanced procedures. These more advanced procedures are currently performed by [an RDA]. To become an RDA, an individual must either complete a 9- to 11-month full-time program offered by a community college or private sector school approved by the [DBC] or may use a work-based pathway and complete 18 months of work experience and three additional short-term courses. In addition, the RDA must complete continuing education, maintain licensure through a renewal process with the [DBC] every two years and be under the complete jurisdiction of the DBC and all its regulatory powers.
>
> In contrast, the Dental Assistant (DA) is an entry-level individual that must complete two courses within 12 months after employment that total 10 hours. These courses are not reported to the [DBC] and are often not completed for many months or not at all. The DBC has no legal authority over this category of assistant since they are unlicensed. In a tracking process, these individuals are basically non-existent. This unlicensed dental assistant can literally have been a waitress, hotel worker, or just graduated from high school and (if this bill passes) be performing these technically advanced procedures within weeks of employment with little oversight. Moving these duties to an unlicensed dental assistant provides no accountability with the [DBC] or protection to the consumers of California.
>
> This bill is in direct conflict with the very definition of the role of an unlicensed dental assistant. In [BPC § 1750], a dental assistant is one who provides "basic supportive dental procedures . . . that have technically elementary characteristics, are completely reversible . . . ". Neither of these two duties fit into the category of completely reversible, basic, or supportive in nature and they include the use of dental handpieces and the use of acid etch (a 37% concentration of phosphoric acid) on the patient's teeth. It is also in contradiction with the intent of the original

> legislation as stated in [BPC § 1740] that provides "the continual advancement of persons to successively higher levels of licensure with additional education and training."
>
> Their stated purpose for this bill is to address the "issue with RDA shortages due to the licensure of the registered dental assistants." We would agree that there is a shortage of RDAs - as well as dental assistants and hygienists - but would assert that it is not licensing that is causing the shortage. In fact, data from the [DBC] shows that the number of RDA's has remained stable over the past six years.

The *California Dental Hygienist's Association (CDHA)* writes in opposition that "(1) dentists are not in agreement that the procedures are reversible, some believe the procedures are irreversible, (2) there is no data to support the claim that there is a shortage of DAs/RDAs, and (3) that unlicensed DAs earn minimum wage, often without benefits and RDAs are paid more and expect benefits." Specifically:

> This bill would allow dental assistants to perform coronal polishing and to place dental sealants. Both duties are now under the scope of practice of only licensed individuals: [RDAs], [RDHs], and licensed Dentists.
>
> Both procedures are irreversible. Coronal polish uses abrasives, which remove enamel. Dental sealants require an acid etch with phosphoric acid, which creates pores in the tooth to allow the sealant material to adhere.
>
> CDHA has met with the bill's sponsor, the California Dental Association (CDA), and Assembly Member Carrillo's office. In reviewing the fact sheet and in discussion with CDA and the author's office, we must alert members of the following:
>
> 1. Allowing unlicensed dental personnel to perform these duties with only a certification course and no formal education will compromise patient safety as these individuals would have no background knowledge of anatomy of the tooth, medical emergencies that could arise and/or corrective procedures that need to take place.
>
> 2. Parents of children needing these procedures would not be aware that the person performing these procedures was licensed or unlicensed, setting up two standards of care.
>
> 3. Coronal polish/placement of dental sealants are not reversible procedures.
>
> 4. Both procedures if done incorrectly could result in discomfort and, in the case of dental sealants, pain due to the child's bite being affected.
>
> 5. Direct supervision by the dentist does not mean dentists will oversee the procedure or watch that the procedure is being done correctly. Direct supervision merely requires the dentist to be in the office.

6. Dental assistants cannot currently "enroll and complete courses to receive certificates through programs approved by the Dental Board to perform coronal polish and place sealants." Section 1073.3 and 1074 (b) of the California Code of Regulations state: Each student must possess the necessary requirements for application for RDA licensure or currently possess an RDA license. The requirements for licensure include completion of a board approved RDA educational program or 18 months of work experience.

7. There is not a documented shortage of dental assistants in California. The data presented in the fact sheet is national data. [DBC] statistics indicate that there has not been a decrease in the number of [RDAs]. The lack of unlicensed dental assistants in California is anecdotal only. Arguably, pay and employee compensation likely have a greater impact.

8. Of the states allowing dental assistants to perform these procedures, all but two states (Nevada and Arizona) require either some form of licensure or a minimum two years of work experience prior to taking certification courses for these procedures.

9. If this bill passes, [RDAs] will lose their jobs. The existing career ladder will cease to exist as these are two of the primary duties allowed to [RDAs]. Dentists would no longer need to employ RDAs when a cheaper under educated workforce was available.

10. Notably, the RDA license already provides a very accessible entry into the oral healthcare profession. Currently, RDAs may become licensed either through an education/training program or two years of on the job training alone. If this bill passes, [RDAs] will lose their jobs.

CDHA strongly supports the existing career ladder for RDAs. As part of a dental team, we believe that these procedures can only be performed safely by licensed dental professionals. Our patients, especially the children, deserve to have licensed professionals doing irreversible procedures.

The *Foundation for Allied Dental Education (FADE)* writes in opposition:

We have seen many legislative initiatives over the years, however, none with such detrimental impact to the dental consumers of California as [this bill]. As written, this bill allows for an unlicensed, uneducated and unregulated population of entry-level workers to perform intra-oral functions that have historically been delivered safely and proficiently by licensed personnel who shall be directly impacted by the depletion of duties and functions within their licensed category.

First and foremost, we all recognize that the pressure for allied healthcare personnel across medical and dental disciplines has been greatly impacted by the global pandemic, however, the reality is that the workforce shortage rationale used to defend legislative change over the past 40 years has resulted in nothing more than a decrease in state and national numbers of qualified personnel. We continue to experience a lack of general interest, recruitment and retention in dental assisting careers without research to identify the root cause. Meanwhile,

organized dentistry continues to believe that removal of educational standards, licensure and regulated duties will result in a dramatically different outcome. In reality, every effort to address access-to-care and workforce shortages have led to nothing more than depletion of qualified personnel, lack of enforcement, and an exponential increase in the aiding and abetting of the illegal practice of dentistry.

Additionally, current [BPC § 1750] defines a dental assistant as "an individual who, without a license, may perform basic supportive dental procedures [which] are those procedures that have technically elementary characteristics, are completely reversible, and are unlikely to precipitate potentially hazardous conditions for the patient being treated." Unless and until the author and the sponsors of [this bill] can demonstrate how the two procedures proposed to become legally allowable for an unlicensed person to perform meets the statutory definition of basic, technically elementary, completely reversible and unlikely to cause harm to a patient, we ask that the Committee vote against passage of [this bill].

Lastly, it should be noted that the American Dental Association's Commission on Dental Accreditation for Dental Assisting considers the performance of coronal polishing and the application of pit and fissure sealants to be expanded functions and not included in the Standards for Accreditation for programs nationwide.

We thank you for your time and attention to our opposition and the relevant positions justifying our opposition. We fully recognize the need for comprehensive review and revision of the dental assisting career ladder, the pathways for licensure, mandatory education and the educational regulations for programs, courses and providers – [this bill] is not in any way a comprehensive approach to addressing the needs of the dental office and will only serve to continue to deplete the most valued and trusted personnel we have in our profession – the [RDA].

POLICY ISSUES FOR CONSIDERATION:

Reversible Procedures. There is disagreement between the sponsor of this bill and the opposition as to whether the procedures under this bill are "reversible." There is no set definition of reversible, although it is generally understood to mean that the tooth can be restored to the state it was in before the procedure.

The sponsor argues that a properly performed polish does not alter teeth in a significant way, and therefore the term "reversible" is not applicable. The opposition argues that the micro abrasions caused by the polish are not reversible.

The sponsor also argues that sealant can be removed, and is therefore reversible. The opposition argues that the acid etch preparation for the sealant is not reversible, and if improperly performed, can result in severe injury.

Arguably, any procedure improperly performed can result in irreversible harm, and unlicensed dental assistants are currently allowed to perform a number of procedures that, if improperly executed, can result in permanent damage. This includes application of topical agents, placing and removing orthodontic separators, examining and seating removable orthodontic appliances,

removing post-extraction dressings, and removing sutures, among other things. Ultimately, existing law required the supervising dentist to ensure these procedures are performed properly. If this bill passes this Committee, the author may wish to work with the DBC and stakeholders on the definition of "reversible."

Regulation of Dental Assistants. The opposition to this bill argues that the DBC has no control over unlicensed dental assistants. While dental assistants are not specifically licensed, every dental assistant must operate under a supervising dentist who is responsible for ensuring the competency of the dental assistant. The supervising dentist has a license, and if they allow a dental assistant to perform incompetently, their license would be subject to discipline. If this bill passes this Committee, the author may wish to work with the DBC and stakeholders on the liability of a supervising dentist relative to an incompetent dental assistant.

RDA Workforce Pipeline. The opposition points out that the procedures under this bill are procedures that RDAs and RDHs perform, and only after significantly more training than required under this bill. They also point out that RDAs who only perform coronal polishing or apply sealants may no longer have a reason to renew their license.

If this bill passes this Committee, the author and sponsors may wish to work with the DBC on a more comprehensive reform to the dental assisting career ladder. One avenue may be working with the Office of Professional Examination Services (OPES) within the Department of Consumer Affairs to perform additional occupational analyses of the dental assistant and RDA profession specific to the procedures outlined under this bill.

IMPLEMENTATION ISSUES:

Board-Approved Course. The DBC currently approves certificate courses for both of the procedures under this bill. However, they are currently tailored to RDAs who have completed one of the traditional RDA licensure pathways. If this bill passes this Committee, the author and sponsors may wish to work with the DBC and educators to ensure the courses for unlicensed dental assistants fulfill the relevant knowledge and training gaps.

Proof of Course Completion. This bill requires a dental assistant to submit proof of completion of the DBC-approved courses to the DBC. Since dental assistants are unlicensed nor registered in any way with the DBC, it is unclear whether the DBC currently has a way to utilize or store these documents. If this bill passes this Committee, the author and sponsor may wish to work with the DBC to ensure it aligns with the DBC's operations.

Duplicative Requirements. This bill requires, among the other requirements, that dental assistants complete a two-hour course covering the Dental Practice Act and an eight-hour course in infection control. However, these courses are already required for all dental assistants. It is unclear whether these courses are in addition to or duplicative of the existing requirements. Further, because this provision is similar to the existing dental assistant enacting statutes (BPC § 1750) but is not identical and contains no cross-references, it is unclear whether this bill would create a separate pathway to dental assisting.

AMENDMENTS:

To ensure there is a responsible supervising dentist of record, proof of compliance with the requirements of the bill, and additional oversight from the supervising dentist, the author should amend the bill as follows:

On page 2 of the bill, after line 10, insert:

> *(c) The supervising dentist and dental practice where the procedures are performed shall be responsible for determining the competency of the dental assistant, consistent with subdivision (y) of Section 1680.*
>
> *(e) The dental practice where the procedures are performed shall maintain a record of compliance with the training requirements under this section.*
>
> *(d) The supervising dentist shall be listed in the record. If there is more than one supervising dentist, each supervising dentist shall be listed. For a pit and fissure sealant performed by a dental assistant, the supervising dentist must review all completed procedures.*
>
> *(e) The dental practice shall maintain the record for a minimum of two years after the dental assistant leaves the practice.*
>
> ~~(c)~~ *(f)* The procedure shall be performed only after the dental assistant has provided evidence to the board they have completed a board-approved course in the procedure.

REGISTERED SUPPORT:

California Dental Association (sponsor)

REGISTERED OPPOSITION:

California Dental Assistants Association
California Dental Hygienists Association
Foundation for Allied Dental Education (FADE)
4 individuals

Analysis Prepared by: Vincent Chee / B. & P. / (916) 319-3301

California Dental Association
1201 K Street, Sacramento, CA 95814
800.CDA.SMILE cda.org

AB 2276 (Carrillo)

Expansion of Scope of Practice for Dental Assistants

Dentistry, like many other professions, was hit hard by the onset of COVID-19. This unprecedented public health emergency led to approximately 97% of dental offices closing completely during the initial months of the 2020 shelter-in-place orders. Even though dental offices are operating at a capacity near pre-pandemic levels, preexisting workforce shortages, particularly dental assistant (DA) positions, have been exacerbated by the pandemic.

In November 2021, 87% of dental offices nationally reported that when compared to pre-pandemic, it was extremely challenging to recruit and hire dental assistants.[1] In the same survey, 44% of providers identified trouble filling vacant staff positions has limited their practice's ability to treat more patients. Lastly, according to the American Dental Association, over the last 10 years there has been a nearly 50% decline[2] in the number of first-year enrollment in dental assistant programs.

Dental assistants are often trained on the job and play a vital role in supporting the entire dental team. Currently, dental assistants can enroll and complete courses to receive certificates through programs approved by the Dental Board of California to perform coronal polishing and place sealants, but they cannot perform these tasks until receiving registered dental assistant (RDA) licensure.

AB 2276 would expand the scope of practice of dental assistants to include coronal polishing and placement of sealants under direct supervision once they have successfully obtained the appropriate certifications.

This bill will help alleviate some of the dental assisting workforce issues that dental practices throughout California have been facing in three primary ways:

- Allows dental assistants to perform duties to the limits of their certifications without needing to complete a costly RDA program and exam.
- Provides DAs additional opportunities to learn about the dental assisting career ladder.
- Balances the needs of dental practices who are struggling to hire dental team members that expand the ability to provide care while also protecting patients by ensuring DAs are appropriately trained and supervised to perform these new duties.

[1] American Dental Association, Health Policy Institute, *COVID-19: Economic Impact on Dental Practices*. 2021.
[2] American Dental Association, Health Policy Institute, *Survey of Dental Assisting Education Programs*. 2021.

Updated March 15, 2022

The Honorable Marc Berman
Chairman, Assembly Business and Professions Committee
1020 N Street, Suite 379
Sacramento, CA 95814

March 23, 2022

AB 2276 (Carrillo)
OPPOSE

Assemblymember Berman,

The **California Dental Hygienist's Association** (CDHA) requests you oppose AB 2276, a bill that would allow unlicensed dental personnel to perform irreversible dental procedures, which potentially harms the most vulnerable dental patients, children.

This bill would allow dental assistants to perform coronal polishing and to place dental sealants. Both duties are now under the scope of practice of only licensed individuals: Registered Dental Assistants (RDAs), Registered Dental Hygienists and licensed Dentists.

Both procedures are irreversible. Coronal polish uses abrasives, which remove enamel. Dental sealants require an acid etch with phosphoric acid, which creates pores in the tooth to allow the sealant material to adhere.

CDHA has met with the bill's sponsor, the California Dental Association (CDA), and Assembly Member Carrillo's office. In reviewing the fact sheet and in discussion with CDA and the author's office, we must alert members of the following:

1. Allowing unlicensed dental personnel to perform these duties with only a certification course and no formal education will compromise patient safety as these individuals would have no background knowledge of anatomy of the tooth, medical emergencies that could arise and/or corrective procedures that need to take place.

2. Parents of children needing these procedures would not be aware that the person performing these procedures was licensed or unlicensed, setting up two standards of care.

3. Coronal polish/placement of dental sealants are not reversible procedures.

4. Both procedures if done incorrectly could result in discomfort and, in the case of dental sealants, pain due to the child's bite being affected.

5. Direct supervision by the dentist does not mean dentists will oversee the procedure or watch that the procedure is being done correctly. Direct supervision merely requires the dentist to be in the office.

6. Dental assistants **cannot currently "enroll and complete courses to receive certificates through programs approved by the Dental Board to perform coronal polish and place sealants."** Section 1073.3 and 1074 (b) of the California Code of Regulations state: Each student must possess the necessary requirements for application for RDA licensure or currently possess an RDA license. The requirements for licensure include completion of a board approved RDA educational program or 18 months of work experience.

7. There is not a documented shortage of dental assistants in California. The data presented in the fact sheet is national data. Dental Board statistics indicate that there has not been a decrease in the number of Registered Dental Assistants. The lack of unlicensed dental assistants in California is anecdotal only. Arguably, pay and employee compensation likely have a greater impact.

8. Of the states allowing dental assistants to perform these procedures, all but two states (Nevada and Arizona) require either some form of licensure or a minimum two years of work experience prior to taking certification courses for these procedures.

9. If this bill passes, Registered Dental Assistants will lose their jobs. The existing career ladder will cease to exist as these are two of the primary duties allowed to licensed dental assistants (RDAs). Dentists would no longer need to employ RDAs when a cheaper under educated workforce was available.

10. Notably, the RDA license already provides a very accessible entry into the oral healthcare profession. Currently, RDAs may become licensed either through an education/training program or two years of on the job training alone. If this bill passes, Registered Dental Assistants will lose their jobs.

CDHA strongly supports the existing career ladder for RDAs. As part of a dental team, we believe that these procedures can only be performed safely by licensed dental professionals. Our patients, especially the children, deserve to have licensed professionals doing irreversible procedures.

We respectfully request you to vote "No" on AB 2276.

Sincerely,

Heidi Coggan, RDHAP, BS
President
California Dental Hygienists' Association

cc: Members, Assembly Business & Professions Committee

April 15, 2022

Carmen Dones, PhD
Board President
Dental Hygiene Board of California
2005 Evergreen Street, Suite 1350
Sacramento, CA 95815

Anthony Lum
Executive Officer
Dental Hygiene Board of California
2005 Evergreen Street, Suite 1350
Sacramento, CA 95815

Re: Assembly Bill 2276

Dear Dr Jones, Mr Lum and Dental Hygiene Board Members:

We are writing on behalf of the dental assisting community to urge you to oppose Assembly Bill 2276.

The California Dental Association is seeking a statutory change to have an unlicensed dental assistant perform the more advanced procedures of coronal polishing and application of pit & fissure sealants. These more advanced procedures are currently performed by a Registered Dental Assistant (RDA), requiring either completion of a 9 to 11-month full-time program offered by a community college or private sector school approved by the Dental Board or completion of 15 months of work experience and three additional short-term courses. In addition, the RDA must complete continuing education, maintain licensure through a renewal process with the Dental Board of California every two years and be under the complete jurisdiction of the DBC and all its regulatory powers.

In contrast, the Dental Assistant (DA) is an entry-level individual that must complete the Infection Control and CA Dental Practice Act courses within 12 months after employment that total 10 hours. While Coronal Polishing and Pit &Fissure certificate courses currently exist, they are available only to students in an RDA program or to those who are eligible to take the RDA exam by on-the-job pathway, which is verification of 15 months of work experience – which gives foundational background, knowledge and experience in the dental office prior to taking the course.

Completion of these courses is not reported to the Dental Board of California and are often not completed for many months or not at all. The DBC has no legal authority over this category of assistant since they are unlicensed. In a tracking process, these individuals are basically non-existent. No tracking, discipline, oversight or continuing education of these unlicensed assistants will be provided for with this bill. Under this bill, the unlicensed dental assistant can literally have been a waitress, hotel worker, or just graduated from high school and be performing these technically advanced procedures within weeks of employment with little oversight. **Moving these duties to an unlicensed dental assistant provides no accountability with the Dental Board or protection to the consumers of California**.

Allowing an unlicensed dental assistant to perform these two duties without any accountability to the dental board is unacceptable. Consider this example (from actual DBC hot sheet): an existing RDA had their license revoked and was quoted as saying “it doesn’t matter, I can just work as a DA”. Direct supervision by the dentist does not mean that dentists will actually oversee the procedure or ensure that the procedures are being done correctly. It only requires that the dentist is physically in the facility.

The stated purpose for this bill is to address the ‘issue with RDA shortages due to the licensure of the registered dental assistants.’ We would agree that there *is* a temporary shortage of RDAs - as well as dental assistants and hygienists - but would assert that it is not licensing that is causing the shortage. In fact, data from the Dental Board shows that the number of RDA’s has remained stable over the past six years and those pursuing their RDA license is showing signs of stability following the pandemic (2051 licensed in 19/20; 1653 in 20/21 and 851 in 6 months of 21/22).

There will be “unintended consequences” if this bill passes. This move to deregulate the RDA will only push career-oriented professionals out of the field due to the dilution of their scope of practice by shifting these two important duties to an unlicensed assistant. Dentistry is in competition with other industries that pay as well or better and offer better benefits. Moving sealants and coronal polishing to the unlicensed dental assistant removes incentives for those who are considering becoming an RDA. Moving these duties from the RDA to the DA category will make the shortage WORSE. We have heard from NUMEROUS members of our organizations that are trained and seasoned RDA professionals who will leave dentistry, viewing this as a huge step in the destruction of their career.

The dental assisting community worked very hard many years ago to make dental assisting a career rather than a dead-end job. The career ladder concept provided not only entry-level access in the form of the unlicensed dental assistant but the development of the RDA and the RDAEF licensures. The Orthodontic Assistant and Sedation Assistant permits were added in 2010 as a joint effort between the Dental Assisting Alliance and CDA to accommodate the specific specialties of orthodontic and oral surgery assistants.

This bill is in direct conflict with the very definition of the role of an unlicensed dental assistant. In Business & Professions Code 1750, a dental assistant is one who provides "basic supportive dental procedures . . . that have technically elementary characteristics, are completely reversible . . . ". Neither of these two duties fit into the category of completely reversible, basic, or supportive in nature and they include the use of dental handpieces and the use of acid etch (a 37% concentration of phosphoric acid) on the patient's teeth. The Commission on Dental Accreditation (CODA) considers these duties to be expanded functions and are not included in the Standards for Accreditation for programs nationwide.

This bill, as it is written, would allow a person with no dental knowledge or background to take Infection Control and the CA DPA courses today and tomorrow be taking the Coronal Polishing and Pit & Fissure Sealants courses. They could be treating patients the day after – again with no foundational background, knowledge or experience in the dental office. **This is an unacceptable standard of care**. It also undermines the intent of the original legislation as stated in Business & Professions Code 1740 that provides “*the continual advancement of persons to successively higher levels of licensure with additional education and training.”*

Here are some questions for your consideration:

- How are coronal polishing and pit & fissure sealants considered basic supportive duties (with technically elementary characteristics, completely reversible or unlikely to precipitate potentially hazardous conditions for the patient)?
- Is there such a strong demand for these duties that licensing should be bypassed?
- How will adding these duties to the unlicensed dental assistant’s scope of practice help the dental assisting shortage?
- How does this bill protect the patient from potential harm or provide accountability should harm occur?

What dentistry needs is well-qualified, well-educated personnel with a well-defined scope of practice that protects the dental consumers in California.

Thank you for your consideration as this bill is NOT in the best interest of the consumers of California. We urge you to oppose AB 2276. Should you have any questions, feel free to contact us.

Sincerely,

The California Dental Assisting Alliance

California Association of Dental Assisting Teachers
California Dental Assistants Association
Dental Assisting Educators Group
The RDAEF Association

PATIENT CARE
RINSES/PASTES

Minimal Intervention

Aug. 1, 2008

Polishing Enamel—PART 7 of 10

Click here to enlarge image

Polishing Enamel—PART 7 of 10

by Shirley Gutkowski, RDH

In the world of minimal intervention, the dental hygienist's friend, prophy paste, may actually be the enemy. Saving enamel and causing the least amount

of damage during dental procedures is at the core. At first glance, polishing paste doesn't seem harmful. Dental hygienists polish teeth every day and never think twice about it. But polishing paste, with its spinning bits of lava rock, does damage the enamel (see “Whether They Need it or Not," RDH magazine, November 2001).

Healthy enamel is quite visibly damaged by prophy paste. The coarser the paste, the more damage that occurs, and yet all manufacturers of prophy paste report that coarse is the biggest seller. When offering samples, they offer coarse because they need it to be competitive with what the customer uses daily. However, we now have so many other options on polishing paste, enabling us to do much more for our patients' enamel health.

Air polishing doesn't get much publicity, yet it is the most versatile of all polishes. It is a necessary component of advanced enamel lesion detection and sealant placement. Failing to prepare the tooth with an air polish before using a DIAGNOdent could lead to a false reading. Preparing the tooth for a sealant with a prophy brush and regular paste, or even paste without additives such as fluoride or flavoring oils, places the tooth at high risk for a sealant bomb. There can be nothing on the tooth before placing a sealant. The organic plug must be removed as it is a packed house of caries pathogens that will continue to break down the enamel.

There are two main types of air polishing powder. One is the traditional sodium bicarbonate, and the other is calcium carbonate. Mint is often added to make it a little more palatable. When using the sodium bicarb, the angle of the tip is at 90 degrees to the tooth, allowing the powder to hammer off the stain. While this is violent, it does not remove as much enamel as pumice. Setting the powder knob to very low powder and very high water gives great results for the majority of patients.

The calcium carbonate powder, ProphyPearls, uses microsphere technology to remove stain. Using an angle between 40 and 60 degrees, the spheres roll the stain off the teeth. This also helps decrease the damage to the sulcus. Using the 90-degree angle in pits and fissures blasts out or obliterates the organic plug, helping sealant retention.

Click here to enlarge image

Pumice polishing pastes have no therapeutic value to enamel at all. Offering it as an option to your patients instead of automatically doing it as the finishing touch to a prophy is better for their enamel. Polishing before the prophy is also worth considering. This can lower the bacteria in the created aerosols and create even more damage to enamel affected by a thick biofilm coating.

On the other hand, use of a therapeutic polish can diminish sensitivity and help restorations last longer. Not many clinicians think of the open margins of esthetic restorations as being caused by improper polishing paste. The damage is so minute that even wearing loupes won't help until stain starts to gather. Polishes made for esthetic restorations use a different abrasive that isn't as damaging to the expensive materials as pumice.

Therapeutic polishing pastes, or smart pastes, contain a variety of ingredients that do a number of things, most notably decrease sensitivity. People who have trouble with ultrasonic scaling can have a very comfortable appointment after a polish with one of the sensitivity polishes. Cold water may also be more comfortable for people if they are polished with one of the smart pastes listed in the box.

A regular toothpaste is often in order for polishing. Its low abrasiveness is better for the enamel, although it's a challenge for clinicians to use because it spatters. Even some of the advanced or smart prophy pastes can act in a hostile manner toward the most well-meaning hygienist.

Choosing the right prophy cup is useful here. Hard cups do more damage to enamel than soft, and the faster the spin the more damage that occurs. Most dental hygienists know this innately, and press the rheostat to RPM in the red zone when patients have

tough stain.

This, of course, is very detrimental to the enamel. One of the problems with reviewing the research on the damage done by polishing pastes is that all the studies are done with different speeds, different cup flexibility, and different webbing. These inconsistencies make it impossible to formulate a PICO question that delivers meaningful results. The short answer is that the faster, the more webbing, and the stiffer the cup, the more damage to the enamel and dentin when using traditional paste.

Click here to enlarge image

Many cups are also made of latex, which creates a potential problem for those who suffer from latex allergy. To do the least damage and best job, choose wisely. A flexible cup at slow speeds with some webbing is the best option.

Back to the soft prophy paste options — there is a new cup design that keeps the pastes from splattering. The Elite prophy cup is made by Young and has webbing on the outside that keeps the saliva clump on the tooth.

Since the goal of polishing is to remove stain, really think about who needs to have their teeth polished. If stain is present, make a choice for the right kind of polish for the presentation and possibly remove it

with an ultrasonic scaler. One size polishing paste does not fit all.

In this series of articles, I'm trying to bring you the new science, the new products, and how and when to use them. I encourage you to put this series into a binder to keep on hand, and add to it. As these articles go to press two months after they're submitted, lots of things change. Contact me if you think I've missed something, or just add it to the information here. Keep the MI philosophy in mind.

About the Author

Shirley Gutkowski, RDH, BSDH, FACE, is co-director of CareerFusion and a practicing dental hygienist. She is co-author of the bestselling book, The Purple Guide: Developing Your Clinical Dental Hygiene Career with Amy Nieves, RDH. She can be contacted at crosslinkpresent@aol.com.

LATEST IN RINSES/PASTES

SPONSORED CONTENT

Rinses/Pastes

OraCare rinse: Decreasing calculus, plaque, bleeding, and more

Kristin Goodfellow, RDH

July 28, 2021

Oral Pathology

Tongue chewing: Causes, treatments, and information for patients

Nancy W. Burkhart, EdD, MEd, BSDH, AAFAAOM

May 10, 2021

Rinses/Pastes

Modern oral rinses: A revolution in dentistry

Melissa Turner, BASDH, RDHEP, EFDA

Dec. 1, 2020

Rinses/Pastes

Chlorhexidine—the good, the bad, and the ugly

Kristin Goodfellow, RDH

April 1, 2020

Patient Education

Social media's footprint in dentistry

Jessica Raymond-Allbritten, BASDH, CRDH

Nov. 1, 2019

Career & Profession

CHX: We don’t like it! Why are we still using it?

July 1, 2019

Alternative Practice

Finding a dream job behind the walls

Anne Nugent Guignon, MPH, RDH, CSP

May 9, 2019

PATIENT CARE
RINSES/PASTES

Whether they need it ...or not!

Nov. 1, 2001

Are you compelled to polish every tooth? Dental researchers advise a re-evaluation of methods, materials, and modalities.

Are you compelled to polish every tooth? Dental researchers advise a re-evaluation of methods, materials, and modalities.

by Shirley Gutkowski, RDH, BSDH

We have identical goals — dentists and hygienists — healthy patients. Removal of the enamel by polishing is nowhere in the top 10 things to worry about during a prophy appointment. It isn't earth shattering; people don't die from it, but it isn't totally harmless. With few exceptions, hygienists are uncomfortable with the prospect of eliminating polishing from their sequence of patient care. "It is the finish," they'll argue. They like to have their patients leave with that "clean" feeling. Polishing is the final activity hygienists do to help their patients.

"Mmmm, I love to have my teeth cleaned. They feel so good," patients say, and "Ahh, the perfect end to a prophy appointment." The patients are happy; their minds are on what a good hygienist you are. Their teeth feel clean. Their teeth feel clean.

Hygienists have major occupational physical distress, including back pain, wrist pain, and loss of sensation or tingling in their hands. Patients think the polish is the reason they came to see the dentist. We're killing ourselves removing calculus, repetitively applying many hundreds of pounds of force per day removing

calculus with some of the smallest muscles in the body. We're using leverage that incorporates the sternocleidomastoid, deltoids, trapezius, and latissimus dorsi muscles of the back as well as some lesser-known deep muscles. We twist, angle, and work in a dark, often bloody field. We expose ourselves and our families to infections, all so our patients can run their tongues across their teeth after we polish and say with satisfaction, "Mmmm, that feels great."

Patients' total appreciation for that feeling is overrated. Should the patient's perceived need for polished teeth override the science of polishing? Our quest for that goal is attainable in various ways. How or why we get there is the topic of this article. The science of polishing has become counterintuitive to many hygienists. Outside influences and motivators perpetuate the impulsive self-enslavement that dental hygienists have towards polishing. So ingrained is this procedure into a hygienist's every day practice, that selective polishing may never be accepted as the norm.

Economics of the hygiene appointment
Dental hygiene schools around the country teach polishing as a means to remove plaque and stain. Plaque is an infectious agent; stain is an entity with no impact on health or disease. In comparison, dental students — future dental-practice owners — are taught certain myths about polishing that eventually

influence the way hygienists are expected to perform in those future dentists' practices. Prophy pastes — or abrasives, as they are taught — are used to remove acquired pellicle and stains. A 1994 textbook for dental students instructs students that fluoride in the prophylaxis paste decreases thermal sensitivity. Another textbook lists polishing as an essential procedure to periodontal therapy.

As future business owners, dental students may be reminded that patients may feel cheated if their teeth aren't polished. They may be taught that the small amount of enamel removed is inconsequential to the customer's wants and perceived needs. They are advised that the work the dentist provides looks better when stains are removed. Generally, hygienists are not as concerned about stain removal as dentists (a.k.a. business owners) are. The end goals appear to be very different: health vs. esthetics.

Not all business owners are unaware, however. Dr. Raymond Thurow, an orthodontist, founder and president emeritus of the College of Diplomates of the American Board of Orthodontists, was very much against polishing teeth. His perspective on the matter — 20 years ago — was that keeping orthodontic bands on teeth for as long as possible would protect them from the ravages of the hygienist's polishing paste.

What's in prophy paste?
Let's start with some mundane facts about polishing:

Most prophy paste made is sold in the United States

Most is sold in 2-gram unit-dose cups

Generally, the ingredients are the same: pumice, feldspar, or diatomaceous earth (in some companies' fine paste formulas); glycerin; flavoring oils; binders (to hold down splattering); and fluoride.

Product characteristics and usage facts:

1. One company sells more than 60 percent of all paste sold in the United States
2. Abrasiveness is determined by particle size and substance — there is no standardization
3. Less than 10 percent of polishing is done with air polishing units
4. The FDA regulates the fluoride content and safety of prophy paste
5. The most common paste sold is coarse
6. Approximately 50 percent of hygienists use coarse as their primary paste
7. Most dental hygiene schools teach students to use "fine" paste
8. Approximately 15 percent of hygienists use fine as their primary paste

The last four pieces of information are intriguing. Hygienists are educated to use fine paste; however, the most popular paste is coarse. What happens between school and the office? Production goals for

the hygiene department are heavily time-dependent. In many practices, the hygiene department is under scrutiny to get the job done quickly and efficiently. If that means rubbing off some enamel, well, so be it. And yet, it doesn't have to be that way.

One of the founding principles of a dental hygiene visit is plaque removal. Plaque removal can be attained by:

> Toothbrushing — the most time-consuming, least damaging, and most instructive of all
> Hand instruments
> Power scalers
> Fine paste used in a conventional manner with angle and cup
> Self-adjusting prophy paste

Prophy pastes generally feature grades of increasing coarseness, signifying larger and larger pieces of cooled, crushed, volcanic lava, called pumice. Some prophy pastes contain abrasives other than pumice; however, pumice is the leader by far.

The size, hardness, and shape of the abrasive particle determines the manufacturer's labeling: extra coarse, coarse, medium, fine, and extra fine. The smaller or softer the particles, the finer the paste. Larger, sharper, or harder particles do remove more stain faster than smaller particles, but at the expense of restorative materials, enamel, and, more notably, dentin.

Through the decades, different studies have shown that anywhere from one to 12 microns of enamel can be removed. The cause for concern has been that the fluoride-rich layer of enamel — the part that is most resistant to acid attack — is the top 4 microns.

Research studies

The way researchers study polishes raise very interesting questions with even more interesting answers. In reading research, it's important to look at the whole picture. For example, one study measured a polishing agent at 3.5 times the load usually employed by practitioners. That change, in and of itself, is neither bad nor good. When one variable is magnified as this one is, it's safe to carry the information over to practice. What made the information useless to daily practice, however, is that the research team polished 15 times as long and only 25 percent as fast as hygienists do in normal practice!

Some researchers looked at the qualities of the polish itself vs. its stain removal qualities. As prophy paste is used, the abrasive particles break down. The larger or harder the abrasive particles are, the longer it takes and more difficult they are to break down. Some pastes never break down.

The newest paste, called "self-adjusting," uses perlite as the abrasive medium. Perlite, it was found, can start out with a particle size consistent with medium paste particles. Perlite particles are sheet-like in

shape and are of volcanic glass. During clinical use, the particles become aligned and the sharp, pointed grains crush rapidly and become dull. This transformation takes seconds and converts a medium paste into a polishing compound safe for use on esthetic restorations. It is half as abrasive, or aggressive, on tooth structures as a coarse prophy paste.

Another research topic concerns the potential damage that prophy paste does to restorative dentistry. From amalgams to fancy composites, shards of lava rock and other abrasive choices erode, dull, and decrease the life of many types of dental restorations.

Microflora is another aspect of interest to researchers. Does the simple act of polishing affect the amount and quality of the bacteria residing in the mouth? Some say "yes;" others disagree.

Dental professionals speak
Dr. Esther Wilkins, author of Clinical Practice of the Dental Hygienist, sees the automatic use of abrasives during a prophylaxis as overkill and harmful to tooth structures. The outer surface of the enamel contains the greatest deposit of fluoride to protect against demineralization. Moreover, the act of polishing cementum and dentin opens the dentinal tubules increasing thermal sensitivity. Dr. Wilkins recommends only toothbrushing during the OHI

portion of the hygiene appointment to remove plaque.

Dr. Wilkins points out that every pass of an instrument removes plaque. In the course of removing calculus and stain with hand and powered instruments, clinicians are disturbing bacterial colonies and removing unsightly non-pathogenic stain as well as plaque. Any roughness remaining on a tooth is likely calculus that cannot be removed by polishing. It is understood that there is a cosmetic obligation for polishing teeth. To satisfy patients, she advocates selective polishing with the finest possible paste — even over-the-counter toothpaste is a good choice.

Dr. Wilkins also muses on the inconsistency of polishing as part of a prophylaxis at no additional cost vs. topical fluoride treatments at what she considers to be shamefully high fees in some practices. Instead, dental practices should charge extra for polishing as a potentially harmful non-health-beneficial procedure, and do topical fluoride treatments routinely at no additional cost.

In tests at the CRA laboratory in Provo, Utah, Dr. Rella Christensen and her colleagues tested different abrasives in commercially available prophy pastes obtainable in the late 1980s. Her research shows less than a 1-micron loss of enamel regardless of the abrasives used. Using impressions, photography,

scanning electron microscope, and assays, her team determined that whatever effect to the enamel had occurred from the abrasive was resolved in 90 days. The mild arching or semicircular pattern of erosion unique to spinning abrasives became less and less as time wore on.

Damage to dentin is another matter. The devastation to the CEJ was not isolated to the use of any abrasive in any prophy paste. Improper angulation of the prophy cup at the CEJ did enormous damage — much more so and longer lasting than the effect on enamel. The photograph of the damage looked suspiciously like an abfraction. Root surfaces remained disfigured, thus creating a niche for further plaque accumulation. Unfortunately, this damage can happen without the clinician knowing it in the sulcus. The research team surmised that the niche might not become evident until the gingiva becomes recessed.

Earlier that same decade, a study used a split-mouth design with 15 subjects to show professional polishing as statistically superior to tooth brushing. One half of the mouth was polished with zirconium silicate polish until no plaque remained as evidenced by disclosing solution. The other half of the mouth was self-brushed by the subjects using the Bass technique and zirconium silicate polish with the same goal of negative disclosing solution evidence. Then, the subjects refrained from oral self care for the three-day duration of the study. At the end of the time period,

the researchers found that the polished teeth had statistically significant lower plaque scores.

That sounds good; but there's a downside. In tests to determine if incorporating stannous fluoride into pastes was helpful, the pastes with silicate and silicone as abrasives apparently blocked uptake of the stannous fluoride. The researchers surmised that the silicone in the paste formed an anti-wetting film that blocked fluoride uptake.

Inconsistency in data is difficult to handle. Since there are so many variables, it's difficult to gather similar results when testing polishes. Many textbooks, including those for dental assistants and dentists, as well as the American Dental Hygienists' Association's (ADHA) position on polishing simply state that polishing should not be done as a matter of course. Each individual tooth should be evaluated with the idea that polishing is a damaging procedure with very few positive qualities. The ADHA and textbook authors, therefore, put the decision to polish into the hands of individual clinicians.

Selective Polishing

Dental hygiene schools teach selective polishing as a means to remove extrinsic stain. Students are instructed to use their clinical judgment to select, tooth by tooth, which ones need polishing and which level of coarseness to use. This method combines the science of dental hygiene with the perceived patient

want/need for cosmetic polishing. One drawback to selective polishing is that it does not address the clinicians' deep, inaccurate longing to provide quality care for the whole mouth, and not skip anything.

Anne Guignon, RDH, MPH, has developed a unique way of achieving old goals. Guignon has advanced what she calls "stealth polishing." She addresses the science of plaque removal and the patients' esthetic needs by removing plaque and stain with a tunable ultrasonic scaler. Then she addresses the patients' psychological need (OK, hers too) by using a self-adjusting polish.

Guignon selects the teeth patients know about: The facials of the upper anteriors, facials and linguals of the lower anterior teeth, and perhaps a few other selected sites. Then she polishes the selected teeth quickly and lightly using soft cups and minimal contact with the teeth using far less than the two grams of paste available in the unidose cup. The perlite in the self-adjusting paste immediately breaks down from a medium paste for stain removal to a polishing compound, resulting in improved luster of the enamel.

With "stealth polishing," patients get the physical and psychological feeling of having had their teeth polished. This method may well be the best answer to the polishing issue.

What do patients think?

Not much has been written about patients' perceptions of polishing. Clinical observations and mind reading are the two major ways dentists and dental hygienists determine patients' desires with respect to polishing.

One recent study targeted patients' ideas on skipping polishing completely. Before the hygienists began the prophys, the patients were instructed on the rationale for polishing as well as its contraindications. The presentation was five to six minutes long. Then, patients were asked if they would object to a prophylaxis that did not include polishing. The majority of newly educated patients did not object.

In an atmosphere of hurried appointments, however, it may not seem practical to engage patients in a five or six minute conversation on the cost: benefit analysis of polishing. Yet, some argue that when something is beneficial, it is imperative that hygienists take the time.

The concept of another recent survey was to compare patients' knowledge and attitudes with what dental hygienists think patients want. Twenty-two oral health care providers from an Internet discussion group responded to a request for help with a survey. The providers sent responses from over 200 patients. Each patient was asked to respond to a short list of statements before treatment was initiated. The statements were designed to prompt "yes" or "no"

responses and to determine what patients knew about polishing

Eighty-one percent of the patients responding said they liked to have their teeth polished. Seventy-five percent think it is necessary. This implies that patients may say they like it, but in reality, they think they need it. If the majority of patients think it's necessary, they would likely not decline even if they hated it. Ninety-five percent of dental hygienists think patients expect it.

In-office topical fluoride
Initial studies showed that polishing was a necessary part of topical fluoride application so it could bond with the enamel by removing the surface pellicle. Pre-application polishing increases the cost of providing topical fluoride in the public health arena. To see if it really was important to polish teeth before applying fluoride, public health studies were designed to find out.

Numerous researchers concluded that brushing the teeth with a regular toothbrush and flossing was more beneficial to fluoride uptake than polishing with abrasive prophy paste. Prophy pastes with fluoride, without fluoride, and a control were compared to toothbrushing (without toothpaste!), and toothbrushing was clearly superior.

The results of numerous similar studies freed up public health dental teams to apply topical fluoride

after a toothbrushing demonstration thus lowering the financial and time expenses. The findings also nudge the traditional model of dental health professionals who insist that polishing before topical fluoride application is essential.

An early study on the addition of fluoride to prophy paste supported its inclusion as a means to incorporate fluoride into the enamel. The idea was to replace the fluoride from the rich outer layer of enamel that was removed by prophy paste.

Now we know that fluoride in prophy paste is not effective as a replacement or an adjunct. Manufacturers today include it to satisfy the paradigm of dental hygienists.

Changing your own traditions

Sometimes, although information is thought through and used, time wears on it and, like the self-adjusting paste, the edges become dull. The information becomes effective in a different way. Keeping current on changes in science is time consuming but not impossible. Dental hygiene colleges, dental schools, and medical schools have mountains of information available to us.

The Internet also may be helpful. The more information available for clinicians to use, the more important it is that they get off of "auto pilot" and do what is right for their patients, not just what seems right.

All dental health care providers know that brushing and flossing are vital parts of proper oral health. Patients do not do it often enough or properly, as evidenced daily in private practice and research. The five minutes that hygienists spend polishing teeth could be much better spent on oral hygiene instructions that include disclosing solution and toothbrushing; better yet, an oral cancer screening.

For some reason, polishing is a hot button for hygienists and dentists, and making a change may require a staff meeting! Nevertheless, true selective polishing, stealth polishing, or asking patients/clients if they'd like to have their teeth polished is a first step that may be more palatable to both clinicians and patients/clients.

References available upon request.

Author's note: Clinpro™, by 3M ESPE, is a self-adjusting prophy paste.

Shirley Gutkowski, RDH, BSDH, has been a full time practicing dental hygienist in Madison, Wis., since 1986. Ms. Gutkowski is published in print and on Internet sites, and speaks to groups through Cross Links Presentations. She can be contacted at dentwrite@aol.com

---

Polish Trivia
Here are a few more basic facts to baffle friends at

your next party:

Average polishing time per tooth surface is 4.5 seconds
The prophy cup spins at an average speed of 2,571 rpm
The load applied is 1.42 N. (Remember N? This is where your college chemistry courses come in handy. N is a newton. A newton is a unit of force required to move one kilogram of mass one meter per second per second. I know that explanation clears up your confusion.)
The load is inversely related to visibility and access, which means that the harder it is to see, the shorter time and less pressure is spent polishing that tooth
The presence of stain increases time, load, and rpm
Enamel is nearly 20 times more resistant to abrasion than dentin

---

Contraindications to polishing

Lack of extrinsic staining
Newly erupted teeth
Areas of demineralization
To remove heavy plaque
Inflamed pockets or sulci
After perio therapy with inflammation still present
To smooth after ultrasonic use

- Any restorative material subject to scratching: porcelain, gold, acrylics, silicates, sealants
- Patient has communicable disease
- Exposed cementum
- Patient reports sensitivity
- Xerostomia

The position paper of the ADHA can be seen in its entirety at www.ADHA.org. The paper concludes: "Polishing should not be considered a routine part of the oral prophylaxis. The licensed dental hygienist or dentist is best qualified to determine the need for polishing. The ability to judge appropriately which patients/clients should or shouldn't be polished is compromised if a practitioner is not knowledgeable. ADHA believes that licensed dental hygienists and dentists are the best qualified to perform polishing procedures."

LATEST IN RINSES/PASTES

SPONSORED CONTENT

Rinses/Pastes

OraCare rinse: Decreasing calculus, plaque, bleeding, and more

Kristin Goodfellow, RDH

July 28, 2021

Oral Pathology

Tongue chewing: Causes, treatments, and information for patients

Nancy W. Burkhart, EdD, MEd, BSDH, AAFAAOM

May 10, 2021

Rinses/Pastes

Modern oral rinses: A revolution in dentistry

Melissa Turner, BASDH, RDHEP, EFDA

Dec. 1, 2020

Rinses/Pastes

Chlorhexidine—the good, the bad, and the ugly

Kristin Goodfellow, RDH

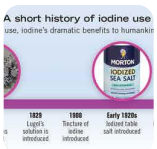
April 1, 2020

Patient Education

Social media's footprint in dentistry

Jessica Raymond-Allbritten, BASDH, CRDH

Nov. 1, 2019



Career & Profession

CHX: We don't like it! Why are we still using it?

July 1, 2019

Alternative Practice

Finding a dream job behind the walls

Anne Nugent Guignon, MPH, RDH, CSP

May 9, 2019

RDH

FOCUS
on PROPHY PASTES and AIR POLISHING POWDERS

THE WIDE SELECTION OF PROPHY PASTES AND AIR POLISHING POWDERS GIVES DENTAL HYGIENISTS THE ABILITY TO PERSONALIZE TREATMENT FOR EVERY PATIENT.

Prophy Paste

COMPANY	PRODUCT NAME	GRIT	FLAVORS	PROPHY	ACTIVE INGREDIENTS	DISPENSING METHOD	UNIQUE FEATURES
3M™ ESPE™	Clinpro™ Prophy Paste with Fluoride	Starts coarse and becomes fine	Mint, bubble gum	Clean and polish	Perlite particles, sodium fluoride	Unit-dose cups with ring	Particles change from coarse to fine, resulting in great stain removal with less abrasion
Biotrol™	Prophy Gems™ Prophy Paste	Fine, medium, coarse, extra coarse	Cool Mint, Wild Berry, cinnamon, bubble gum, Vanilla Orange	Clean and polish	Pumice, 1.23% fluoride	100 unit-dose cups (prepackaged in disposable rings color-coded by flavor)	Gluten-free formula; paste-holding rings that go on the thumb for easier/more secure application; low spatter; effective against tough stains
Brasseler USA	HygienePro Glisten Prophy Paste	Fine, medium, coarse, extra coarse, kids' medium-fine	Mint, chocolate, cherry, root beer, bubble gum	Clean and polish	Sodium fluoride	200 unit-dose cups per box; each box includes one auto-clavable prophy ring	Consistency provides effective, spatter-free performance in a variety of popular flavors and grits
Clear Innova	Fusion Paste Prophy Paste	Coarse	Assorted flavors: mint, cherry, bubble gum, piña colada	Clean and polish	Fluoride ion, 1.23% sodium fluoride active	Place in dappen dish or other suitable container	Nonspatter formula
Crosstex International CROSSTEX PROTECTS	Sparkle-Free™ Prophy Paste	Medium, coarse	Cinnamon, fruity, spearmint, white chocolate	Yes	Pumice, neutral pH, no chemically active ingredients	Single-use cups	Gluten-, dye-, and fluoride-free; contains xylitol; maximum stain removal, minimal enamel loss; spatter-free; optimal rinsability; ideal for patients during or after tooth whitening; free of nuts, soy, milk, eggs, aspartame, and corn/corn products
	Sparkle™ Prophy Paste	Fine, medium, coarse	Bubble gum, Berrylicious Assortment (strawberry/blueberry/raspberry) in coarse and medium grit, cherry, mint, Orange Vanilla, assorted flavors	Yes	1.23% Active fluoride ion	Single-use cups	Gluten-free to eliminate allergic reactions associated with celiac disease or gluten intolerance; optimal rinsability; time-set formula reduces spatter; designed to provide excellent stain removal while minimizing enamel loss; free of nuts, soy, milk, eggs, aspartame, and corn/corn products
DenMat	Smoothie® Prophy Paste	Extra coarse, coarse, medium	Mint (extra course, coarse, medium), grape (medium), cherry (medium)	Clean and polish	Fluoride	2 g individual paste cups	Spatter-free; gluten-free
Dental Technologies Inc	Alpha-Pro® Kids Pack Prophy Paste	Fine, medium	Sweet Cotton Candy, Chocorific Chocolate, Watermelon Wonder, Berry-licious	Clean and polish	Sodium fluoride	Unit-dose cups with ring	Gluten-free formula; children-friendly flavors; spatter free; rinses easily
	Alpha-Pro Prophy Paste with Fluoride	Medium, coarse	Mint, cherry	Clean and polish	Sodium fluoride	Unit-dose cups with ring	Gluten-free formula; spatter free; rinses easily
	Alpha-Pro Prophy Paste without Fluoride	Medium	No added flavor	Clean and polish	Pumice	Unit-dose cups with ring	Gluten-free formula; no added color, flavor, or fluoride; spatter free; rinses easily
Denticator	Zooby® Prophy Paste	Fine, medium, coarse	Turtle Melon™, Gator Gum™, Chocolate Chow™, Happy Hippo Cake™, Growlin' Grrrape™, Spearmint Safari™	Clean and polish	1.23% Fluoride, xylitol	100 unit-dose cups (color-coded by flavor)	Gluten-free formula; free autoclavable Zooby gripper in every bag; unique, kid-friendly flavors; optimal formulation of abrasives and adhesive properties
	Festival	Medium, coarse, coarse plus	Mint, cinnamon, cherry	Clean and polish	1.23% Fluoride, pumice	200 unit-dose cups per bag	Adult paste formulation; low-spatter final polish
	Sure Clean	Medium	Nonflavored	Clean and polish	Pumice	200 unit-dose cups per bag	Flavor-free; fluoride-free; designed for use prior to sealant application, orthodontic banding/bracketing, and bonded restorations
DENTSPLY Professional DENTSPLY PROFESSIONAL	NUPRO® Prophy Paste	Fine, medium, coarse, plus	Mint, orange, Orange Vanilla Swirl, BubbleExtreme™, grape, Zinnamon, Cookie Dough, Razzberry, Cherry Blast, Strawberry Vanilla Swirl, Chocolate Bliss, piña colada, fruit punch	Clean and polish	Pumice, sodium fluoride	Unit-dose cups, jars	Large selection of great-tasting flavors; gluten-free; excellent stain removal and polishing performance; unique proprietary formulation designed to deliver consistent, spatter-free performance; rinses completely and easily
	NUPRO extra care Prophy Paste	Polish, stain removal	Spearmint, peppermint, citrus mint, orange	Clean and polish	Calcium sodium phosphosilicate (NovaMin®), sodium fluoride	Unit-dose cups	Cleans, polishes, and desensitizes; immediate and long-lasting (up to 4 weeks) sensitivity relief from one application; NovaMin calcium phosphate technology releases the teeth's natural building blocks to help build an enamel-like mineral layer
	NUPRO Shimmer Restorative Polishing Paste	Micro-fine	Spearmint	Polish	Micro-fine aluminum oxide	Syringe	Restores the luster and shine of restorative materials (composites and amalgams) without causing damage to the surface; formulated with micro-fine aluminum oxide to protect restoration surface; safe for natural dentition; may be used for full-mouth prophy on patients with a large number of restorations; allows cleaning of partial restorations

Editor's Note: *This list is inclusive of most prophy pastes and air polishing powders sold in the United States. While every attempt has been made to be as comprehensive as possible, there may be inadvertent product omissions.*

ISTOCK PHOTO © RICH LEGG

COMPANY	PRODUCT NAME	GRIT	FLAVORS	PROPHY	ACTIVE INGREDIENTS	DISPENSING METHOD	UNIQUE FEATURES
DMG America	Kolorz™ Prophy Paste	Fine, medium, coarse, X-tra coarse	Assorted Pak (100 cinnamon and 100 mint in medium and coarse), Carnival Pak (100 cotton candy and 100 blue raspberry in fine and medium), Triple Mint (fine, medium, coarse, X-tra coarse), Cherry Burst (medium and coarse), bubble gum (fine)	Clean and polish	Sodium fluoride	Unit-dose cups	Gluten-, aspartame- and saccharin-free; contains xylitol
GC America Inc	MI Paste™ MI Paste Plus™	No grit, no pumice, calcium and phosphate polishing paste	Melon, mint, strawberry, tutti frutti, vanilla	Polish	Recaldent™ (casein phosphopeptide-amorphous calcium phosphate), 900 ppm fluoride (0.2% sodium fluoride)	40 g tube	Gluten-free; no grit topical prophy paste with bioavailable calcium, phosphate, and 900 ppm fluoride (0.2% sodium fluoride)
Glitz Dental Co	Glitz Premium Prophy Paste	Kids' fine, medium, coarse	Blueberry, chocolate, marshmallow, spearmint, strawberry, watermelon	Clean and polish	Fluoride	200 individual cups per box	Enhanced stain remover; high polish
Henry Schein Inc	ACCLEAN® Prophy Paste	Fine, medium, coarse, extra coarse	Mint, bubble gum, chocolate, cinnamon, raspberry, strawberry, tangerine, vanilla, cherry	Clean and polish	1.23% Acidulated phosphate fluoride	Unit-dose cups	Nonspatter; easy, complete rinsing; gluten-free; superior polishing
	ACCLEAN Plus	Gel	Mint, bubble gum	Polish	1.1% Neutral sodium fluoride with micronized calcium hydroxyapatite and casein	Tube	Helps neutralize acids; low abrasion; prescription-strength formula
	ACCLEAN ZERO	Medium	Unflavored	Clean and polish	Pumice	Unit-dose cups	Does not contain oils or fluoride; gluten-free; no color or peanut additives; great alternative for patients with allergies or sensitivities
Ivoclar Vivadent	Proxyt®	Fine, medium, coarse	Mint	Polish and clean (fine); clean (medium and coarse)	Sorbitol, xylitol, sodium, fluoride	55 ml tube	Fluoride-free option

Prophy Paste (continued)

COMPANY	PRODUCT NAME	GRIT	FLAVORS	PROPHY	ACTIVE INGREDIENTS	DISPENSING METHOD	UNIQUE FEATURES
Keystone Industries	Gelato Prophylaxis Cups	Fine, medium, coarse	Bubble gum, cherry, mint, piña colada, orange sherbet, raspberry	Clean and polish	1.23% Acidulated phosphate fluoride	Unit-dose cups	Color-coded tops and easy-to-read labels for convenient use; available in a box of 200 disposable cups and in 6-oz and 12-oz jars; available without dye
	Gelato Primal Prophylaxis Cups	Fine, medium, coarse	Bubble gum, cherry, mint, and tropical punch, assorted pack	Clean and polish	Fluoride, pumice	Unit-dose cups	Gluten-free; contains xylitol; easy-to-read labels
Medicom	Denti-Care® Pro-Polish	Fine, medium, coarse	Bubble gum, mint, cherry, raspberry	Clean and polish	Sodium fluoride 2.7% w/w (1.23% w/w fluoride ions)	Unit dose	Fast stain removal; high polishing ability; low spatter; quick rinsing; fluoride-enhanced formula free of nuts, gluten, aspartame, and latex
Mydent International	DEFEND® Prophy Paste	Fine, medium, coarse	Mint, cherry, vanilla/orange, bubble gum	Clean and polish	1.23% Fluoride ion	200 unit-dose cups	Smooth, pliable, and reduced-spatter formula contains fluoride and a unique blend of cleaning and polishing agents; safely and effectively removes stains from tooth surfaces; gluten-free to assure against allergic reaction; easily rinses clean with water
PacDent	ProPaste™	Fine, medium, coarse	Mint, cherry (medium, coarse), bubble gum (fine), strawberry (medium), grape (coarse)	Clean and polish	Sodium fluoride	Unit-dose cups 2 g	Exceptional polishing and stain-removal ability; fluoride release; great taste; easy rinse-off
Plak Smacker®	Sweet Tooth	Medium	Cotton candy, chocolate, watermelon, berry assortment	Clean and polish	N/A	200 cups per tub	Great flavors that kids love
	Brilliance	Medium, coarse	Mint (medium, coarse) or regular fluoride-free and flavorless (medium)	Clean and polish	N/A	200 cups per tub	Flavored and fluoride-free options
	Prophy Gems	Coarse	Wild Berry, Cool Mint, cinnamon, Vanilla Orange	Clean and polish	N/A	100 rings per box	Four tasty flavors; unique dispensing ring
POPWHITE®	Power of Purple	Coarse, medium, fine	Mint	Clean and polish	1.23% Fluoride, pumice	200 unit-dose cups per box	Cleans, polishes, and whitens; gluten-free; excellent stain removal and polishing performance; very low spatter; patented color science technology
	Power of Pure	Medium	Nonflavored	Clean and polish	Pumice	200 unit-dose cups per box	Flavor free; fluoride free; oil free; wax free; designed for use prior to sealant application, orthodontic banding/bracketing, and bonded restorations
Premier® Dental Products Co premier	Enamel Pro®	Fine, medium, coarse, extra coarse	Bubble gum, cinnamon, grape, mint, strawberry, VanillaMint, RaspberryMint	Clean and polish	Fluoride (mint is available without fluoride); amorphous calcium phosphate (ACP)	Single-dose cups	ACP stimulates remineralization of tooth enamel; increased fluoride uptake; provides a lustrous surface; gluten-free; colorful swirl design; popular flavors
	Glitter™	Fine, medium, coarse, extra coarse	Bubble gum, cherry, mint, strawberry	Clean and polish	Fluoride (mint available without fluoride)	Single-dose cups	Gluten-free, smooth, pliable, spatter-free
	Ziroxide™	Fine, medium, coarse	Mint	Clean and polish	Fluoride (also available without fluoride)	Single-dose cups, 1-lb jars	Gluten-free, creamy texture
Preventech PREVENTECH	Next® Prophy Paste	Fine, medium, coarse, extra coarse	Mint, cherry, vanilla, bubble gum, grape, Tropical Fruit, spearmint, watermelon, cinnamon, Chocolate Mint, wintergreen	Fine grit is polish only; all others are clean and polish	1.23% Fluoride	Unit-dose cups 2 g	Low abrasive fine; nonsplatter; flash rinsing; great-tasting flavors
	Nada® Pumice Paste	Medium	Nonflavored	Clean and preparation	None	Unit-dose cups 2 g	Contains no flavors, dye, oils, or casein phosphopeptidefluoride; no splatter; no effect on bond strength
	MAXmin™ Prophy Paste with NuFluor™	Medium, coarse	Mint, cherry, bubble gum, Orange-Vanilla	Clean and polish	NuFluor, a unique calcium, phosphate, and fluoride chemistry (patent pending); xylitol	Unit-dose cups 2 g	Optimized handling; goes on without splatter; tough on stains; flash rinses to a clean finish
Sabra Dental Products	Sabra Prophy Paste	Fine, medium, coarse	Bubble gum, cherry, piña colada, mint, assorted	Clean and polish	1.23% Acidulated phosphate fluoride, pumice	200 unit-dose cups; disposable prophy ring in each package	Smooth, pliable, and spatter-free application; safely and effectively removes stains from tooth surfaces; gluten free
SmartPractice	SplatrFREE® Sqwiggly® Prophy Paste	Medium	Assorted pack of mint, berry, and bubble gum	Clean and polish	1.23% Fluoride	Unit-dose cups	Colorful packaging appeals to kids and distracts them during exams; spatter free; gluten free
	SmartPractice Brand Prophy Paste	Fine, medium, coarse, x-coarse	Bubble gum, cherry, mint	Clean and polish	1.23% Fluoride	Unit-dose cups	Flavorful, spatter-proof formula; gluten free; economically priced
Sultan Healthcare Inc SultanHealthcare	Topex® Prophy Paste	Fine, medium, coarse, extra coarse	Cherry, mint, piña colada, chocolate mint, bubble gum, Really Raspberry, Root Beer Float, CinnaMint, chocolate, vanilla, strawberry	Clean and polish	Fluoride	Unit-dose cups 2 g	Blend of pumice to remove stains and polish enamel; rinses clean
	Topex Prep & Polish Paste	Fine	Peppermint	Polish	Corundum	Syringe 4 g	Creates a high-level polish and luster; rinses clean
Sunstar Americas Inc SUNSTAR GUM Butler GUIDOR	Butler® Prophy Paste	Fine, medium, coarse, plus	Bubble gum, cherry, mint	Clean and polish	Pumice	Unit-dose cups; free prophy ring in every box	Spatter-free formula that is excellent for stain removal but gentle on enamel
Ultradent Products Inc	UltraPro® Tx	Fine, medium, coarse	Cool Mint, Walterberry, bubble gum, Orange Dreamsicle	Yes	Fluoride, potassium nitrate	Unit-dose cups	Spatter-free formula; popular flavors (including dye-free); rinses easily and completely to eliminate residual grittiness; gluten-free
	UltraPro Tx Pure Prophy Paste	Medium	Nonflavored	Yes	Pumice	Unit-dose cups	Free of fluoride, potassium nitrate, flavors, gluten, dyes, and oil; rinses easily and completely to eliminate residual grittiness; ideal for use before sealant placement or bonding procedures; spatter-free

Prophy Paste (continued)

COMPANY	PRODUCT NAME	GRIT	FLAVORS	PROPHY	ACTIVE INGREDIENTS	DISPENSING METHOD	UNIQUE FEATURES
Water Pik® Inc	Waterpik Prophy Paste	Fine, medium, coarse, extra coarse	Bubble gum, melon, strawberry, cherry, mint, variety pack	Clean	1.23% Fluoride in a phosphate mixture; sweetened with xylitol and sucralose	Single-dose cups	Full line of grits and flavors; does not contain aspartame, saccharin, or gluten; available in a five-flavor variety pack
	Waterpik Soft Shine® Prophy Paste	Micro-fine white sapphire particles	Mint	Clean and polish	Micro-fine white sapphire particles	Single-dose cups	Removes stains and fine scratches without damaging surfaces; safe and effective on restorations and natural teeth
	Waterpik Soft Shine Polishing Paste	Micro-fine white sapphire particles	Mint	Polish restorations	Micro-fine white sapphire particles	4 g (0.14 oz) multi-dose syringe	Formulated with micro-fine white sapphire particles for optimum polishing of restorations; creates mirror-like luster on composites, amalgams, porcelain, ceramic, and gold restorations
Young Dental	Oral-B® Practitioner Series™ Prophylaxis Paste	Fine, medium, coarse	Mellow Mint, cinnamon, Orang-A-Tangy, bubble gum, assorted (mint, cinnamon, orange)	Clean and polish	1.23% Fluoride, xylitol	200 unit-dose cups (color-coded by grit)	Excellent balance of abrasive and adhesive properties designed for low spatter and maximum stain removal; formulated with xylitol and 1.23% fluoride
	D-Lish® Prophy Paste	Fine, medium, coarse	Mint, cinnamon, cherry, grape, Dreamsicle Orange, Fresh Strawberries™, Berry Bliss™, Mint Medley Assortmint™, key lime, assorted, Summer Drink Mix™ (Piña Colada, Strawberry Margarita, Mint Mojito)	Clean and polish	1.23% Fluoride, xylitol	200 unit-dose cups (color-coded by grit)	Pumice-based formula designed to reduce spatter and improve stain removal; gluten-free; contains 1.23% fluoride and xylitol; patients can choose from more than a dozen delicious flavors
	Zooby® Prophy Paste	Fine, medium, coarse	Turtle Melon®, Gator Gum™, Chocolate Chow®, Happy Hippo Cake®, Growlin' Grrrape®, Spearmint Safari®, Animal Pack™	Clean and polish	1.23% Fluoride, xylitol	100 unit-dose cups (color-coded by flavor)	Gluten-free formula; free autoclavable Zooby gripper in every bag; unique, kid-friendly flavors; optimal formulation of abrasive and adhesive properties

Air Polishing Powder

COMPANY	PRODUCT NAME	GRIT	FLAVORS	CLEAN	POLISH	ACTIVE INGREDIENTS	DISPENSING METHOD	UNIQUE FEATURES
3M ESPE	C&P Powder™ Air Polishing Powder	N/A	Spearmint	Yes	Yes	Sodium bicarbonate	Air polisher	Removes stain and plaque; easy dispensing bottle
ACTEON North America	AIR-N-GO® "Classic" Prophy Powder	76 µm	Neutral, cola, raspberry, peppermint, lemon	Yes	Yes	Sodium bicarbonate	AIR-N-GO handheld air polisher or any other air polisher	Flavors based on 100% natural aromas or essential oils; gentle to gingiva and soft tissue
	AIR-N-GO "Pearl" Prophy Powder	55 µm	Neutral	Yes	Yes	Calcium carbonate	AIR-N-GO handheld air polisher or any other air polisher	Small spheres are gentle and can be used on crowns and veneers
	AIR-N-GO "Perio" Prophy Powder	25 µm	Neutral	Yes		Glycine	AIR-N-GO handheld air polisher with Perio Nozzle	Low abrasiveness of the Perio Air-N-Go Powder preserves the tooth enamel and the most delicate anatomical areas
Biotrol	Perfect Choice Air Polishing Powder	N/A	Cool Mint	Yes		Sodium bicarbonate	Bottle with squirt cap	Ready to use; designed to work with any polishing unit
Bosworth Co	Prophy Powder	100 µm	Grape, spearmint, orange, strawberry, raspberry, lemon lime	Yes	Yes	Sodium bicarbonate	ProphyBrite™ Air Polisher	Less abrasive than prophy paste; removes stubborn stains, plaque, and debris
DENTSPLY DENTSPLY PROFESSIONAL	Prophyjet® Prophy Powder	N/A	Mint	Yes	Yes	Sodium bicarbonate	Air polishing	Removes extrinsic stain and plaque
	Cavitron® JET-Fresh® Prophy Powder	N/A	Mint	Yes	Yes	Aluminum trihydroxide	Air polishing	Sodium-free; removes extrinsic stain and plaque
Hu-Friedy Hu-Friedy EMS	AIR-FLOW® Classic Powder	65 µm	Lemon, mint		Yes	Sodium bicarbonate	Air polishing with Hu-Friedy EMS AIR-FLOW units	Prevents dental caries and supports the treatment of inflamed gingiva
	AIR-FLOW Perio Powder	25 µm	Neutral		Yes	Glycine	Air polishing with Hu-Friedy EMS AIR-FLOW units	Extra-fine grains provide effective disruption of biofilm in periodontal pockets up to 5 mm in the United States (10 mm in Canada)
	AIR-FLOW Classic Comfort Powder	40 µm	Lemon		Yes	Sodium bicarbonate	Air polishing with Hu-Friedy EMS AIR-FLOW units	Fine sodium bicarbonate provides comfortable supragingival cleaning
KaVo	Prophy Pearls	67 µm	Neutral	Yes		Calcium bicarbonate	Powder	Round shape, with no jagged edges to damage the enamel; provides infinite number of contact points for thorough cleaning and polishing
	Prophy Powder	50 µm–60 µm	Berry, mint, orange, cherry	Yes		Sodium carbonate	Powder packets	Pleasing flavors for a more palatable experience
Micro-Vac	Prophy-Ez®	Fine	Spearmint	Yes	Yes	Sodium bicarbonate	1-lb Jar	Unique anticaking and free-flow formula can be used in any air polishing unit; removes plaque and stains; neutralizes acidity in mouth; gluten-free; made in the United States
NSK	FLASHpearl	75 µm	Neutral		Yes	Calcium carbonate	15 g Sachet or 300 g bottle	FLASHpearl granules are small and spherically shaped, which means more efficient cleaning and less tooth surface damage
OraTec	OraJet	Proprietary	Mint		Yes	Sodium bicarbonate	3-lb Bottle with pour spout	Free-flow particle size; two anticlogging agents
Sabra Dental Products	Sabra Prophy Powder	N/A	Spearmint	Yes	Yes	Baking soda, flow control ingredients	EZ-pour bottle for less waste; prevents clogging	Pleasant flavor; no clogging; safely and effectively removes stains from tooth surfaces; gluten-free

Clinical and Experimental Dental Research / Volume 7, Issue 5 / p. 763-771

ORIGINAL ARTICLE

Open Access

Microleakage of pit and fissure sealings placed after enamel conditioning with phosphoric acid or with self-etching primers/adhesives

Stefanie Amend, Roland Frankenberger, Christina Boutsiouki, Vanessa Scharrelmann, Julia Winter, Norbert Krämer

First published: 07 April 2021
https://doi.org/10.1002/cre2.420

Abstract

Background

It is still not fully understood what pretreatment is best for achieving maximum tightness for pit and fissure sealings (PFS).

Aim

This study investigated microleakage of PFS placed after etching with phosphoric acid or after the application of self-etching primers/adhesives (SEPA).

Design

131 third molars were assigned to ten groups. In Hel-P, Helioseal® was applied after phosphoric acid etching. In the other groups, SEPA were used (Dyr-AP: Adper™ Prompt™ L-Pop™, Dyract® Seal; Bea: BeautiSealant Primer and Paste; Hel-Exp: Experimental primer, Helioseal®; Hel-Cl: Clearfil™ SE Bond[1], Helioseal®). Specimens were stored in distilled water at 37°C (28 days), followed by 3500 thermocycles and staining with 5% methylene blue (M) or 5% silver nitrate (S). After methylene blue staining and sectioning, microleakage was assessed light microscopically. During silver nitrate staining, specimens were dissolved by 32% HCl and remaining PFS were evaluated under a SEM.

Results

Tightness, percentage of penetrated area, and maximum dye penetration were best for Hel-P and Hel-Cl ($p < 0.05$).

Conclusions

Phosphoric acid etching of enamel and Clearfil™ SE Bond resulted in the best sealing quality. Methylene blue staining allowed the evaluation of more criteria (fissure shape, voids, sealant penetration depth) compared to silver nitrate.

1 INTRODUCTION

Recent systematic review shows that fissure sealing with resin-based materials has been an effective way to reduce caries formation by 11%–51% in 2 years compared to no sealing (Ahovuo-Saloranta et al., 2017). Pit and fissures of first permanent molars are the first to be affected by caries up to the age of 12 years, even in countries with mean DMFT <2 (Marthaler, 2004). It is this way clear that pit and fissure sealants are a very important tool in caries prevention. However, as with all resin materials, adhesion is the Achilles' ptern of long-term preservation of sealants and loss of it leads to microleakage (Kidd, 1976). When a resin-based material is placed, competition arises between polymerization shrinkage forces and bond strength to the subsequent dental structure (Van Meerbeek et al., 2011). If bond strength between sealant and enamel is weaker, a fracture is caused and a way through the gap is formed as the material separates itself from enamel, therefore resulting in microleakage and failure of the restoration (Kidd, 1976). A minimal degree of leakage can be tolerated and not cause a reaction. But in some cases it can become the source of postoperative pain and recurrent caries, leading to restoration failure (Kuhnisch et al., 2012).

Resin sealants exhibit the highest retention rate after 5 years (83.8%) compared to glass ionomer sealants (5.2%) (Kuhnisch et al., 2012). A disadvantage of resin sealants compared to glass ionomer cements is their technique sensitivity during clinical application, as excellent control of moisture is needed. According to their composition resin-based sealants can be conventional resins, compomers or giomers[2] . Compomers are polyacid-modified composites with fluoride-releasing silicate glasses (Kuhnisch et al., 2012). An acid–base reaction takes place as compomer absorbs water, which facilitates cross-linking structure and fluoride release. Giomers are composites with pre-reacted glass-ionomer fillers in their resin matrix (Ntaoutidou et al., 2018).

Pit and fissure sealing is described as a “micro-invasive treatment,” as the conditioning of the tooth surface results in an irreversible removal of a small amount of dental hard tissue (Schwendicke et al., 2015). The outer enamel layer of permanent teeth is prismless and even when it's abraded due to mastication, the inner surface of the fissure, where sealants are placed, remains prismless (Schwendicke et al., 2015). For the conditioning of the prismless enamel layer, several treatment options have been suggested in the literature, like the application of phosphoric acid (Erdemir et al., 2014), the use of self-etching primers/adhesives (Ntaoutidou et al., 2018), air-abrasion (Kramer et al., 2008) or laser conditioning (Karaman et al., 2013). Etching the enamel with 35%–37% phosphoric acid for at least 30 s is the gold standard method to remove

the prismless enamel surface layer prior to the application of resin-based pit and fissure sealants. Over the past years, self-etching primers/adhesives have been tested as pretreatment for pit and fissure sealing sacrificing the etching with phosphoric acid and rinsing with water-spray (Ntaoutidou et al., 2018). Self-etching primers/adhesives are supposed to condition the enamel with acidic functional groups and polymerizable acidic components (Pashley & Tay, 2001). Among their advantages, they reduce clinical steps (Perry & Rueggeberg, 2003) and the possibility of contamination of the occlusal surface with saliva, over-drying/wetting is avoided and they can be easily used in children with limited compliance (Ntaoutidou et al., 2018). On the one hand, systematic reviews show worse adhesion of sealants placed after the application of self-etching primers/adhesives to enamel compared to etching with phosphoric acid (Birlbauer et al., 2017; Botton et al., 2016; Pitchika et al., 2018). On the other hand, retention (Erbas Unverdi et al., 2017) and microleakage (Nahvi et al., 2018) of sealants used in combination with self-etching primers/adhesives have been shown to be equal to sealants with prior etching. However, marginal leakage of sealants with self-etching primers could also be due to unsuccessful adhesion at first place, as self-etching adhesives show reduced adhesion to enamel (Van Meerbeek et al., 2011). pH of the self-etching primer, as well as addition of functional monomers like 10-MDP in its composition, also play an important role on the adhesive performance of self-etching adhesives (Van Meerbeek et al., 2011).

In microleakage studies a penetrant is needed in order to mark the available areas for penetration around restorations or around sealants. The one mostly used is methylene blue (Agrawal & Shigli, 2012; Kramer et al., 2008), followed by fuchsine (Gillet et al., 2002; Hatirli et al., 2018; Heintze et al., 2008), and the more expensive silver nitrate (Heintze et al., 2008). A review by Heintze et al. (2008) showed no difference between the aforementioned substances (Heintze et al., 2008).

The aim of the present study was to compare the efficacy of a pretreatment with 37% phosphoric acid prior to pit and fissure sealing with the utilization of self-etching primers/adhesives as conditioners. Furthermore, the results of two dye penetration tests, namely either with 5% methylene blue or with 5% silver nitrate, used for the assessment of the quality of preventive pit and fissure sealants in vitro should be checked against each other. The null hypotheses tested were: (i) different procedures of enamel conditioning have no impact on the sealing ability of pit and fissure sealants and (ii) there are no differences between the two dye penetration methods.

2 MATERIAL AND METHODS

2.1 Specimens selection and preparation

This study has followed the CRIS guidelines for in-vitro studies as discussed in the 2014 concept note (Krithikadatta et al., 2014). The conduction of the present laboratory study was approved by the local ethics committee of the Justus-Liebig-University Giessen, Germany (AZ 143/09).

131 caries-free (ICDAS II Code 0), permanent third molars were collected and stored in 0.5% chloramine-t solution (Chloramin T Trihydrat, Carl Roth, Karlsruhe, Germany) for up to 21 days at 4°C. Occlusal surfaces were cleaned by air polishing (PROPHYflex 3, KaVo Dental, Biberach/Riss, Germany; powder: Clinpro™

Glycine Prophy Powder, 3M Oral Care, Seefeld, Germany), and they were then randomly allocated to the following experimental groups ($n = 20$): (i) 37% phosphoric gel + Helioseal® (Ivoclar Vivadent, Shaan, Liechtenstein), control group (Hel-P), (ii) Adper™ Prompt™ L-Pop™ (3M Oral Care) and Dyract® Seal (DENTSPLY DeTrey, Konstanz, Germany) (Dyr-AP), (iii) BeautiSealant Primer and Paste (SHOFU Dental, Ratingen, Germany) (Bea), (iv) Experimental primer and Helioseal® (Ivoclar Vivadent) (Hel-Exp), (v) Clearfil™ SE Bond (Kuraray Noritake Dental, Okayama, Japan) and Helioseal® (Ivoclar Vivadent) (Hel-Cl) (Table 1). Helioseal® was tested as a conventional resin sealant, Dyract® Seal as a compomer and BeautiSealant as a giomer. Sealants were placed by a single calibrated operator and were polymerized with Bluephase lamp (Ivoclar Vivadent/light output of 1200 mW/cm^2 ± 10%). Half of the specimens proceeded to methylene blue penetration test (M) and the other half to silver nitrate penetration test (S). Specimens were stored in distilled water at 37°C for 28 days (Incubator Typ B20, Heraeus Holding, Hanau, Germany), and were then thermocycled for 3500 cycles (+5°C and +55°C, dwell time 30 s; TCS 30, Syndicad, Munich, Germany) to simulate an artificial aging.

TABLE 1. Information about the materials under investigation, and their experimental procedures

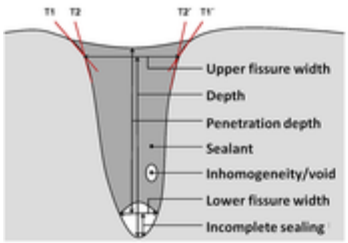
Group	Material	Manufacturer	LOT Nr	Components	pH	Experimental procedure
Hel-P	Pluraetch	Pluradent	T02656	37% H_3PO_4 in aqueous solution, thickeners, dye	0.9	Etching gel applied for 60 s, rinsed off with water spray for 10 s, air-dried to visually control etching pattern
	Helioseal®	Ivoclar Vivadent	S38608	Bis-GMA, DMA, TiO_2, photoinitiator, stabilizers	-	Sealant applied, then polymerization for 40 s
Dyr-AP	Adper™ Prompt™ L-Pop™	3M Oral Care	569,183	Liquid 1 (red cushion): MOP, Bis-GMA, photoinitiator, stabilizers Liquid 2 (yellow cushion): water, HEMA, polyalkene acid, stabilizers	1	Adhesive applied for 15 s, gently dried with air (repeated three times with new blister each time),

Abbreviations: BHT, butylated hydroxytoluene; Bis-GMA, bisphenol A diglycidyl methacrylate; CQ, camphorquinone; DGDMA, diethyleneglycol dimethacrylate; DMA, dimethacrylate; EDMAB, ethyl-4-dimethylaminobenzoate; MDP, 10-Methacryloyloxydecyl-Dihydrogenphosphat; MOP, methacrylate organophosphate; SiO_2, silicon dioxide; TiO_2, titanium dioxide.

2.2 Methylene blue penetration test (M)

For the conduction of methylene blue penetration test, specimens' apices were sealed with glue wax (Chemical Dental Laboratory Oppermann-Schwedler, Bonn, Germany), and the roots were covered with acid resistant nail varnish (Manhattan, Stuttgart, Germany) to prevent a retrograde dye penetration. Followed to that, specimens were centrifuged for 5 min at 30*g* in 5% methylene blue solution (Heraeus Megafuge 8, Heraeus Holding). Upon completion, 1 mm thick slices were produced by a microtome (IsoMet™ 1000 Precision Saw, Diamond Wafering Blade Series 15LC, Buehler, ITW Test & Measurement, Dusseldorf, Germany); the blade being placed perpendicularly to the occlusal surfaces in bucco-lingual direction.

Microscopic evaluation at 40x magnification was performed with a light microscope (Nikon AZ100 M, Nikon, Tokyo, Japan; Software NIS-Elements 4.00.01), and determination of fissure shape (V-, U-, I- and IK-shape) followed. Assessment of the sealing quality was made upon the following criteria: upper and lower fissure width (in µm), fissure depth (in µm), sealant penetration depth into the fissure (in µm), inhomogeneity/voids within the sealant (in %), dye penetration depth (in µm) (Figure 1) (Kramer et al., 2008). Tightness was defined as the absence of dye penetration around the sealant and was calculated from the maximum percentage of dye penetration (see below). The even distribution of fissure shapes on the five different groups was tested by comparing the upper/lower fissure widths.



T1/T1'	Tangent on the occlusal surface near the fissure
T2/T2'	Tangent on the beginning of the fissure
Upper fissure width	Distance between intersections of T1/T2 and T1'/T2'
Lower fissure width	Distance between deepest penetration points of sealant
Penetration depth	Distance between beginning of sealing and lower fissure width
Fissure depth	Distance between upper fissure width and depth of fissure
Incomplete fissure sealing	Distance between lower fissure width and depth of fissure
Inhomogeneity / void	Area of voids within fissure sealing
Dye penetration	Length of deepest dye penetration
Fissure shape	V-, U-, I- or IK-shape

FIGURE 1

Open in figure viewer | PowerPoint

Evaluation criteria for the methylene blue penetration test

2.3 Silver nitrate penetration test (S)

Sealed teeth were stored in 5% $AgNO_3$ solution for 24 h at 37°C (Incubator Typ B20, Heraeus Holding),

followed by a storage in 0.5% *tert*-Butylhydrochinon solution for 24 h at 37°C (Incubator Typ B20, Heraeus Holding) in order to reduce silver ions concentration. For detachment of the pit and fissure sealings from the occlusal surfaces, specimens were immersed in 32% HCl for 5–6 h. Finally, the remaining pit and fissure sealings were removed from the laboratory glasses (No. X655.1, 10 ml, Carl Roth), while remnants of hydrochloric acid were rinsed off with distilled water. Air drying of the pit and fissure sealings followed.

Evaluation was performed under SEM. After sputtering of the pit and fissure sealing with a coating of gold/palladium (BAL-TEC SCD 500 sputter Coater, Bal-tec, Balzers, Liechtenstein) images were obtained (ZEISS SUPRA 40 VP, Carl Zeiss, Oberkochen, Germany; acceleration voltage 15 kV), on which silver particles were displayed in white, and the pit and fissure sealings having a darker color. By means of the software AnalySIS auto (version 5.1), the overall area of the pit and fissure sealings (in µm) was calculated by using the function ROI (region of interest), and by circling the outlines of each pit and fissure sealing in a distance of 2–10 µm. Silver particles were marked in red color and percentage of silver penetration was calculated (Figure 2).

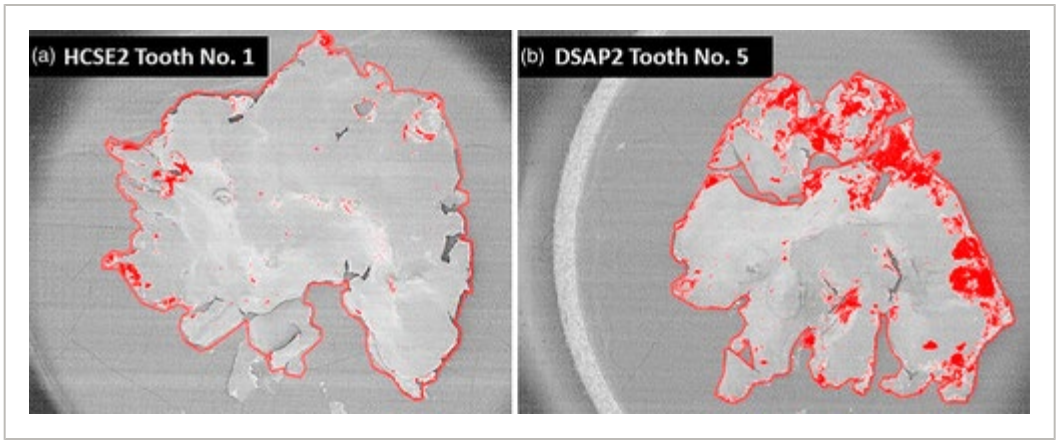


FIGURE 2

Open in figure viewer | PowerPoint

Exemplary illustration of the percentage of penetration area of the pit and fissure sealant. On image 2a, the percentage of penetrated area is small, whereas, it is high on image 2b

2.4 Comparison of methylene blue penetration test (M) and silver nitrate penetration test (S)

To compare both staining methods, obtained images were re-evaluated to assess maximum dye penetration (Figure 3). For methylene blue penetration test, the section with the highest dye penetration score was chosen. Maximum sealant penetration into the fissure and maximum methylene blue penetration around the sealant were measured to calculate the maximum percentage of dye penetration. On the images of silver nitrate dye penetration test, the percentage of dye penetration was assessed by drawing a tangent along the central fissure, measuring the line from the tangent to the outer border of the sealing in the area of maximum sealant penetration, and assessing the penetration depth of the sealant along that line (Figure 3).

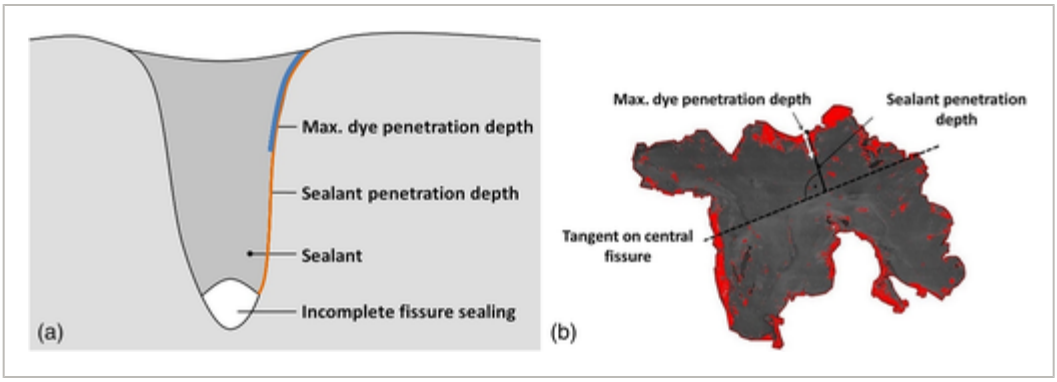


FIGURE 3

Open in figure viewer | PowerPoint

To compare the results of both dye penetration tests, the maximum dye penetration depth was assessed for specimens after the methylene blue penetration test (a), and after the silver nitrate penetration test (b)

2.5 Statistical analysis

Statistical analysis was performed with SPSS 26.0 (IBM Statistics, Armonk, NY, USA). Normal distribution was checked with Kolmogorov–Smirnov test. Medians and interquartile ranges (IQR) were calculated for the evaluation criteria of the methylene blue penetration test (tightness, homogeneity, sealant penetration depth [in %], maximum dye penetration depth, sealant penetration depth [in nm]) and of the silver nitrate penetration test (penetrated area by silver nitrate, total area of sealed fissure, maximum dye penetration depth, sealant penetration depth [in nm]). Non-parametric tests (Kruskal–Wallis) combined with post-hoc tests and Bonferroni correction for multiple comparisons were used to show statistically significant differences between the sealant groups. Differences between the two penetration tests were studied with Mann–Whitney U tests for pairwise comparisons. The significance level was set at $p < 0.05$.

3 RESULTS

No significant differences were noted between the shape of the fissures among the groups ($p = 0.104$, Kruskal–Wallis), showing that fissure forms were equally distributed.

3.1 Methylene blue penetration test (M)

Tightness was significantly higher for control group compared to Dyr-AP-M ($p < 0.001$, Bonferroni) and Bea-M ($p = 0.009$, Bonferroni). It was lower for Dyr-AP-M compared to Hel-Exp-M ($p = 0.023$, Bonferroni), or Dyr-AP-M compared to Hel-Cl-M ($p = 0.001$, Bonferroni). Bea-M also showed significantly lower tightness compared to Hel-Cl-M ($p = 0.021$, Bonferroni) (Table 2).

TABLE 2. Medians [IQR] of parameters evaluated at methylene blue penetration test.

	Tightness (in %)	Homogeneity (in %)	Sealant penetration depth (in %)

Hel-P-M	100 [100-100]^{B}	93 [83-100]^{A,B}	78 [67-92]^{A}
Dyr-AP-M	63 [54-74]^{A}	100 [100-100]^{A}	99 [93-100]^{B,C}
Bea-M	71 [39-86]^{A,C}	86 [71-86]^{B}	79 [69-85]^{A}
Hel-Exp-M	100 [83-100]^{B,C}	85 [83-100]^{A,B}	85 [81-92]^{A,C}
Hel-Cl-M	100 [100-100]^{B}	93 [82-100]^{A,B}	95 [90-100]^{B,C}

Note: Different upper case superscript letters represent statistically significant differences between the groups for each evaluation parameter of the methylene blue penetration test (Kruskal-Wallis, Bonferroni correction, $p < 0.05$).

Presence of internal voids (homogeneity) in the sealants was minimum, albeit with statistical difference among the materials tested ($p = 0.008$, Kruskal–Wallis). Compomer (Dyr-AP-M) showed no internal voids presenting a significantly higher homogeneity than Bea-M ($p = 0.003$, Bonferroni). Conventional resin (Hel-P-M, Hel-Exp-M, Hel-Cl-M) showed medians of 85%–93% for void-free sealings (Table 2).

Sealant penetration depth (in %) was significantly higher for compomer (Dyr-AP-M) compared to giomer (Bea-M; $p = 0.002$, Bonferroni) and control group (Hel-P-M; $p = 0.004$, Bonferroni). Conventional composite with phosphoric acid etching (Hel-P-M) showed worse sealant penetration depth (in %) than the same material with a self-etching adhesive (Hel-Cl-M) ($p = 0.034$, Bonferroni). Moreover, specimens sealed with Hel-Cl-M exhibited significantly higher sealant penetration depths than Bea-M ($p = 0.019$, Bonferroni) (Table 2).

Maximum penetration depth (in %) of methylene blue was significantly lower for the control group with the separate etching step (Hel-P-M) compared to Dyr-AP-M ($p = 0.011$, Bonferroni) and Bea-M ($p = 0.030$, Bonferroni). Additionally, Hel-Cl-M showed significantly lower dye penetration opposed to Dyr-AP-M ($p = 0.016$, Bonferroni) and to Bea-M ($p = 0.041$, Bonferroni) (Table 4).

3.2 Silver nitrate penetration test (S)

Maximum silver nitrate penetration depth (in %) was increased for Dyr-AP-S compared to Hel-Cl-S ($p = 0.013$, Bonferroni) (Table 4). The percentage of penetrated area by silver nitrate was significantly higher for the groups Dyr-AP-S and Bea-S in comparison to Hel-P-S and Hel-Cl-S ($p < 0.05$, Bonferroni) (Table 3). Statistically significant differences regarding the total area of the sealed fissure were observed among groups (Kruskal–Wallis, $p < 0.001$), with Dyr-AP-S and Bea-S having a higher amount of sealant applied to the pit and fissure system than the group Hel-P-S ($p < 0.05$, Bonferroni) (Table 3). Additionally, the total area of the sealed fissure was higher for the giomer group (Bea-S) compared to the resin composite groups applied with self-etching primers/adhesives (Hel-Exp-S: $p = 0.043$, Hel-Cl-S: $p = 0.009$, Bonferroni).

TABLE 3. Medians [IQR] of parameters evaluated at silver nitrate penetration test.

	Penetrated area by silver nitrate (in %)	Total area of sealed fissure (in pixel)
Hel-P-S	2.5 [2.2-3.6]^{A}	548768 [478536-613594]^{A}
Dyr-AP-S	7.4 [6.6-9.0]^{B,C}	1564063 [1215936-2428156]^{B,C}
Bea-S	8.5 [6.6-10.1]^{B,C}	2071117 [1765240-2547224]^{B}
Hel-Exp-S	3.3 [2.7-7.5]^{A,C}	738311 [478882-1820356]^{A,C}
Hel-Cl-S	3.2 [2.6-4.0]^{A}	745916 [595831-939715]^{A,C}

Note: Different upper case superscript letters represent statistically significant differences between the groups for each evaluation parameter of the silver nitrate penetration test (Kruskal-Wallis, Bonferroni correction, $p < 0.05$).

3.3 Comparison between the two methods

Parameters “maximum dye penetration depth (in %)” and “sealant penetration depth (in nm)” were compared for the two penetration methods tested (Table 4). Significant differences were noted between the two penetration tests regarding maximum dye penetration depth, for control group ($p = 0.002$, Mann Whitney U), Dyr-AP ($p = 0.043$, Mann Whitney U) and Hel-Cl ($p = 0.002$, Mann Whitney U), as the silver nitrate penetration test (S) showed significantly higher percentages of dye penetration than the methylene blue penetration test (M). Control group ($p < 0.001$, Mann Whitney U), Hel-Exp ($p = 0.001$, Mann Whitney U) and Hel-Cl ($p < 0.001$, Mann Whitney U) showed significantly different values for sealant penetration depth between the two tested methods. Again, the silver nitrate penetration test (S) showed higher values than the methylene blue penetration test (M).

TABLE 4. Medians [IQR] of dye and sealant penetration depth for both tests.

	Maximum dye penetration depth (in %)	Sealant penetration depth (in nm)
Hel-P-M	0.0 [0.0-0.0]^{A,a}	0.0 [0.0-0.0]^{A,a}
Dyr-AP-M	21.0 [12.3-23.9]^{B,C,c}	1632.4 [1310.8-1738.5]^{B}
Bea-M	18.6 [4.3-31.4]^{B,C}	1410.0 [1161.3-1820.3]^{B,C}
Hel-Exp-M	0.0 [0.0-32.8]^{A,C}	0.0 [0.0-1104.0]^{A,C,c}
Hel-Cl-M	0.0 [0.0-0.0]^{A,e}	0.0 [0.0-0.0]^{A,e}
Hel-P-S	12.0 [8.5-23.2]^{A,B,b}	1849.6 [797.4-2968.0]^{b}

Dyr-AP-S	25.3 [20.1-42.7]^{B,d}	1892.5 [1607.0-2733.2]
Bea-S	21.1 [17.4-36.5]^{A,B}	1746.6 [1332.6-2900.3]
Hel-Exp-S	14.8 [9.4-30.5]^{A,B}	3168.5 [1078.3-3495.1]^{d}
Hel-Cl-S	13.2 [7.0-19.2]^{A,f}	1802.8 [941.5-2907.7]^{f}

Note: Different upper case superscript letters represent statistically significant differences between the groups for each penetration test (methylene blue, silver nitrate; Kruskal-Wallis, Bonferroni correction, $p < 0.05$). Statistically significant differences between the two penetration tests for each pit and fissure sealant group are marked with distinct lower case superscript letters (Mann-Whitney-Test, $p < 0.05$). M corresponding to methylene blue penetration test and S to silver nitrate penetration test.

4 DISCUSSION

The present study aimed to compare the use of phosphoric acid versus self-etching primers/adhesives as enamel pretreatment prior to sealants application. Three different resin materials were used as pit and fissure sealants, Helioseal as a conventional resin-based sealant, the compomer Dyract Seal, the giomer BeautiSealant; and two different dye penetration methods, methylene blue and silver nitrate penetration test, were compared.

Methylene blue penetration test is a reliable method for the evaluation of microleakage adjacent to pit and fissure sealants and has been used in several studies (Gillet et al., 2002). Further advantages of using the methylene blue penetration test are that the dye is not expensive and it is easy to use. On the basis of the microscopic images, many parameters may be measured and specimens can be investigated microscopically (Brocklehurst et al., 1992). The time-consuming specimen preparation and measurements together with the toxicity of methylene blue (acute toxicity after oral intake, hazardous to the aquatic environment) are regarded as disadvantages (Van Meerbeek et al., 2011). For silver nitrate penetration test, the specimen preparation and evaluation may be completed faster. During microscopic evaluation, the entire pit and fissure sealing may be investigated, as dental hard tissues have been dissolved before by storage in hydrochloric acid. Compared to methylene blue penetration test, less parameters are measurable because only sealant material remains for evaluation after dissolution of the specimens' dental hard tissue. All in all, specimens stained with methylene blue allow for the evaluation of additional parameters, as specimens are sectioned with a microtome enabling the assessment of the fissure shape, the number of voids, and the sealant penetration depth, as it was done in the present study. Moreover, the time-consuming and expensive manufacturing of the solutions for silver nitrate penetration test combined with the possible hazards of the chemicals (etching/irritation of eyes/skin, hazardous to the aquatic environment) are disadvantageous for this penetration test (Van Meerbeek et al., 2011). Both penetration tests showed similar % maximum dye penetration within the groups, with the silver nitrate test exhibiting higher percentages, however, significant differences were

material dependent (Table 4). A possible explanation for this could be the fact that with silver nitrate penetration test the whole sealant surface is evaluated for dye penetration, while with methylene blue, evaluation is performed at a certain number of cuts, therefore at a limited percentage of the sealed area. Therefore, null hypothesis ii was rejected.

Regarding specimen preparation, prior to the sealant application it is recommended to clean the occlusal surface either with a low-speed rotating bristle brush combined with pumice slurry or by air polishing, the later was used in the present study. Air polishing was chosen since it has been shown to increase bond strength of sealants and to enhance sealant penetration depth in vitro (Brocklehurst et al., 1992). Despite the fact that fissures demonstrate a variety of shapes (Nagano, 1961), homogenous distribution of specimens along the experimental groups allowed for an unbiased evaluation.

Thermocycling was performed in order to simulate the thermal changes which take place in the oral environment. In accordance with literature, temperature changed alternatively from 5 to 55°C (Heintze et al., 2008). Despite the fact that some published studies show no differences when thermocycling was performed, it was chosen in order to comply with the most of microleakage literature.

After the introduction of phosphoric acid conditioning by *Buonocore* in 1955, enamel etching has been regarded as the gold standard in order to achieve adhesion via micromechanical retention of resin composites and therefore resin pit and fissure sealants (Buonocore, 1955). The application of phosphoric acid exposes prismatic enamel, creates microporosities into which resin-based sealants penetrate and once polymerized, resinous tags and mechanical anchoring are produced (Gwinnett, 1973). According to a recently published systematic review and meta-analysis, phosphoric acid etching combined with the use of resin-based sealants exhibited the best clinical long-term performance in terms of favorable retention rates. All in all, the longevity of sealants placed in combination with primers/adhesives was substandard, though depending on the type of primer/adhesive. The results of the present study confirm the good pit and fissure sealing ability after phosphoric acid etching of enamel, as Hel-P with separate phosphoric acid etching demonstrated lower % maximum dye penetration depth compared to most of the other groups, with both evaluation methods (Table 4). Therefore, null hypothesis i was partially rejected in this respect. On the other hand, self-etching primers/adhesives with acidic methacrylate monomers that do not have to be rinsed off have shown to reduce the time needed for pit and fissure sealing by 1/3 compared to etching with phosphoric acid (1.8 min vs. 3.1 min). This is advantageous in pediatric dentistry due to the limited compliance of children during treatment (Ntaoutidou et al., 2018).

Considering pH-values of the materials used in the present study, 37% H_3PO_4 in aqueous solution had a pH of 0.9, whereas the self-etching primers/adhesives were milder with pH values ranging from 1 to 2.3 (Table 1). Literature comparing phosphoric acid etching with self-etching primers/adhesives shows worse behavior of self-etching primers. An in vitro study by Kanemura et al. (1999) comparing the application of either phosphoric acid or self-etching primers to intact enamel showed that self-etching primers demineralized the enamel insufficiently and resulted in swallower adhesive penetration, shorter resin tags as well as lower bond strength (Kanemura et al., 1999). Short resin tags were also found by Torii et al. (2002) after the application of self-etching adhesives on ground bovine enamel, although tensile bond strength was

comparable to etch-and-rinse adhesives (Torii et al., 2002). As a consequence, the inability of self-etching primers/adhesives to etch and penetrate deep into intact enamel of the occlusal surface may be a reason for the increased microleakage observed for Dry-AP and Bea in both dye penetration methods (Table 4). This finding is also in agreement with the microleakage study by Perry and Rueggeberg (2003).

In group Dyr-AP, the self-etching adhesive Adper™ Prompt™ L-Pop™ was combined with the compomer Dyract® Seal. The application of Adper™ Prompt™ L-Pop™ was conducted in three layers, as multi-coating has been shown to increase microtensile bond strength (Frankenberger et al., 2001). Furthermore, the combination of this adhesive with a compomer increased bond strength in vitro (Frankenberger et al., 2001). For this reason, Dyract® Seal was chosen as pit and fissure sealant in this group. A demineralization pattern similar to the one obtained after phosphoric acid conditioning was caused when Promp™ L-Pop™, with a pH of 1, was applied on prismless enamel. Nevertheless, the use of this self-etching adhesive resulted in significantly lower microtensile bond strength to aprismatic enamel compared to phosphoric acid etching. A clinical trial by Yilmaz et al. (2010) revealed a significantly lower retention rate for Dyract® Seal applied with a self-etching primer/adhesive compared to resin-based sealants and ormocers after 24 months (Yilmaz et al., 2010). A meta-analysis by *Kühnisch* et al. confirmed an unfavorable retention rate of 17.9% (95%-CI: 8.2%–58.0%) after 3 years, and 3.8% (95%-CI: 0.2%–31.8%) after 5 years for compomers used as pit and fissure sealants. In the present study, the tightness of sealings in group Dyr-AP (63% [54%–74%]) was low, though the sealant penetration depth was high (99% [93%–100%]) indicating an insufficient adaption of this dental material to aprismatic enamel (Table 2).

Giomer BeautiSealant, a resin-based sealing material additionally containing inorganic surface pre-reacted glass ionomer cement (S-PRG) fillers based on fluoroboroaluminosilicate glass (Ntaoutidou et al., 2018), was applied in group Bea. It is used in combination with the self-etching BeautiSealant Primer having a mild pH of 2.3. Ntaoutidou et al. (2018) assessed a total retention rate of as low as 6.9% for Beautisealant after 18 months in a randomized controlled clinical trial. A possible explanation was the limited demineralization potential of its self-etching primer (Ntaoutidou et al., 2018), which may also be an explanation for the higher microleakage of BeautiSealant (Table 4).

Different pretreatments seemed to have an impact on the penetration depth of the Bis-GMA-based sealant Helioseal® into the fissure system. The use of Helioseal® in combination with the self-etching adhesive Clearfil™ SE Bond (Hel-Cl) resulted in the highest sealant penetration depth into the fissure (95% [90%–100%), followed by the group Hel-Exp being pretreated with an Experimental primer (85% [81%–92%]), and a lower sealant penetration depth in the group etched with phosphoric acid (78% [67%–92%]). This can be explained by alteration of the contact angle of the occlusal enamel surface after the application of different acids or primers, thus altering the ability of the sealant to flow and spread into the fissure. The tightness of fissures sealed with Helioseal® was high, independently of the pretreatment (phosphoric acid vs. self-etching primer/adhesive) used in this in vitro study (Table 2), showing that the material tightly seals the pit and fissure system.

5 CONCLUSION

Within the limitations of this in vitro study, enamel etching with 37% phosphoric acid, or application of Clearfil™ SE Bond as a self-etching adhesive prior to sealing pit and fissures with resin-based sealants, resulted in the lowest microleakage, and therefore tightest sealing.

The use of the methylene blue penetration test facilitated the evaluation of more parameters compared to the silver nitrate penetration test and was less expensive. Therefore, methylene blue penetration test may be recommended for microleakage studies in the laboratory.

ACKNOWLEDGMENTS

The authors gratefully acknowledge the statistical analysis done by the biostatistician Dr. Johannes Herrmann. We thank Ivoclar, Kuraray, Dentsply, and Shofu for providing the materials.

CONFLICT OF INTEREST

SA, CB, VS, and JW have no conflict of interest. RF and NK got research grants and speaker honorarium from Ivoclar and Dentsply.

AUTHOR CONTRIBUTIONS

Stefanie Amend wrote the paper. Roland Frankenberger and Norbert Krämer conceived the ideas and methodology. Christina Boutsiouki did literature work. Vanessa Scharrelmann did the experiments. Julia Winter did proofreading and assistance with literature work.

Endnote

[1] Clearfil™ SE Bond as self-etch adhesive produced tight pit and fissure sealings comparable with phosphoric acid pretreatment.
[2] Compomer and Giomer sealings showed an inferior performance.

http://dx.doi.org/10.5272/jimab.2016222.1099

Journal of IMAB
ISSN: 1312-773X
http://www.journal-imab-bg.org

Journal of IMAB *Annual Proceeding (Scientific Papers)* 2016, vol. 22, issue 2

EFFECT OF ETCHING TIME AND ACID CONCENTRATION ON MICROMORPHOLOGICAL CHANGES IN DENTIN OF BOTH DENTITIONS

Natalia Gateva[1], Angela Gusyiska[2], Pavel Stanimirov[3], Rossitza Kabaktchieva[1], Ivan Raichev[2]

1) Department of Pediatric Dentistry, Faculty of Dental Medicine, MU, Sofia, Bulgaria

2) Department of Conservative Dentistry, Faculty of Dental Medicine, MU, Sofia, Bulgaria

3) Department of Oral and Maxillo-Facial Surgery, Faculty of Dental Medicine, Medical University - Sofia, Bulgaria

ABSTRACT:

Aim: to compare micromorphological changes in primary and permanent dentin after etching with phosphoric acid (20% and 37,5%) for 7 and 15 sec. by SEM.

Material and methods: The study included 42 primary and permanent teeth, divided into 8 groups by etching time and acid concentration. Enamel and dentin were removed from the vestibular area and after the expiration of etching time samples were washed with water-air stream and dried with light airflow. From each sample 10 magnified images were made from central vestibular area. The cleaning effect was measured in percentage, as a ratio between the number of uncleaned tubules to the total tubules. Results were analyzed with One-way and MANOVA. Post hoc Multiple Comparisons test – SPSS 19 was applied.

Results: The proportion of uncleaned tubules in primary teeth was higher than that of permanent teeth at acid concentration of 20%. At a concentration of 37.5% this relationship is reversed. At 7 sec there was a bigger difference between the share of uncleaned tubules for primary and permanent teeth, while at 15 sec this difference virtually disappears. The difference in the proportion of uncleaned tubules between the two acid concentrations at 7 seconds etching is significantly greater compared to the same difference between the two acid concentrations by etching for 15 sec.

Conclusion: Effectively removed smear layer and no precipitate was observed in primary teeth even at 7 seconds etching with 37.5% acid.

Key words: etching time, primary dentin, permanent dentin, smear layer, SEM, peritubular dentin

The etching is a key moment in the preparation of the tooth for application of adhesive systems which are applied with the Total-etch approach [1]. Considering that, the etching of the dentin is of fundamental importance and at the same time is a problematic area for achieveing sufficient bond strength [2, 3].

In dental practice enamel and dentin are both etched. The goal is to create a chemically clean surface and microretentions [3, 4]. Therefore, a micromechanical bond is created - via the formation of "resin tags" of the adhesive into the dentin tubules as well as a nano mechanical bond - via the penetration of the adhesive in the demineralized space between the collagen fibers of the intertubular dentin [3, 5].

At this stage, the data for a better and a long lasting bond with the dentin after the removal of the smear layer, which is achieved by total etching, prevails [1, 6, 7].

The adhesive dentine bond strength is a function of its morphology and the etching agents [5, 8]. The morphology of the dentin substrate can be changed as a consequence of age-related changes, the presence of carious and non-carious lesions, as well as the type of dentition – primary or permanent [4, 6, 7, 9-13]. The effect of the etching agent depends on the type and concentration of the acid, time and the manner of its application [14-18].

The comparison of the composition and the morphology of the dentin of the primary and permanent teeth shows some differences [8, 10, 16, 19-22]. In a study of the hardness of the coronal dentin's central zone it was found that the dentin in permanent teeth is significantly harder than the one of the corresponding areas in the primary teeth [20, 22-26]. The dentin of permanent teeth is with higher mineralization [27], based on the fact that the hardness is directly related to the degree of mineralization [16, 20, 23]. The primary teeth dentin is characterized by a lower hardness, and hence it is with a lower degree of mineralization in comparison with the one in permanent teeth. A lower calcium and phosphorus concentration in the peritubular and intertubular dentin is found as well as lower micromechanical features [21, 23, 25, 26, 28, 29].

Furthermore, there is a difference in the tubular density and the size of the dentin tubules- characteristics which define the dentin permeability. These differences lead to a different amount of intertubular dentin, which is the largest and most significant component of the dentin in terms of bonding procedures [10, 21, 26, 30].

Studies on the hybride layer, performed on primary and permanent teeth, also indicate for differences in the thickness of this layer. The formed hybrid layer in primary teeth is much thicker than the one in permanent teeth when the same protocol of adhesive application is performed [21, 23, 31].

All of this gives grounds to suggest that the probable reason for these results are the different dentin reactions of deciduous teeth to acid used for etching before the application of the adhesive system [8, 22, 25, 28, 32, 33].

All established parameters to achieve adequate dentin

surface for bonding by application of adhesive systems have been tested in permanent teeth [4-6, 19, 34]. The same clinical protocol is transmitted directly in primary teeth, without taking into consideration the differences in the composition and morphology of dentin that exists between the teeth from both dentitions [21, 23, 26, 35, 36].

The aim of this study is to compare the micromorphological changes in dentin in primary and permanent teeth after etching with 20% and 37,5% phosphoric acid for 7 and 15 seconds by using Scanning Electron Microscope (SEM).

In order to achieve the goal the following task was set:

- to determine the degree of cleaning the smear layer with different concentrations of phosphoric acid and for different etching time.

The working hypothesis is that there are no differences between the dentin in permanent and primary teeth, as wells as that etching time and acid concentration have no influence on the degree of smear layer removal.

MATERIAL AND METHODS

Selection and preparation of experimental samples:The study used intact extracted teeth from both dentitions. The primary teeth were collected from healthy children between the age of 7 and 9 after their parents signed informed consent for the use of the teeth in the experiment. The permanent teeth were also collected from healthy patients aged 55-65 years who also signed informed consent. The deciduous teeth were extracted due to physiological exfoliation or because of orthodontic treatment and the permanent - due to periodontal problems. After extraction, the teeth were placed in 10% formalin solution for 10 minutes, then until the time of execution of the task were stored in saline.

Grouping of the experimental samples. The study included 42 intact teeth (primary and permanent incisors and canines). The teeth were divided randomly into 8 groups of 5 teeth in each group (only primary and only permanent), depending on the etching duration and phosphoric acid concentration (table 1).

Table 1. Grouping of the experimental samples.

Etching / Group/tooth type	20% phosphoric acid		37,5% phosphoric acid	
	7 sec	15 sec	7 sec	15 sec
Group/primary teeth	Group 1 n= 5	Group 3 n= 5	Group 5 n= 5	Group 7 n= 5
Group/permanent teeth	Group 2 n=5	Group 4 n= 5	Group 6 n= 5	Group 8 n= 5

n = number of samples

Preparation the tooth surface. With a turbine round bur (ISO 806 314 001 534 012 for primary teeth and ISO 806 314 001 534 014 for permanent teeth) and water-air cooling a cut in medio-distal direction along the vestibular surface is made. The purpose was pre-marking the depth of removal of enamel and dentine. With a turbine fissure diamond bur (ISO 806204108524835010) and the water-air cooling the enamel and dentin parallel to the long axis of the tooth, at the depth of the round bur marking, are removed. Diamond burs were changed after every three teeth. The surface after drilling was polished with an abrasive disk (ISO 625900372523) each used only for one tooth.

All prepared samples were observed with an optical microscope OLYMPUS VANOX-T under magnification of 25x to 100x, to establish whether the enamel was completely removed from the vestibular surface.

Dentin etching. The etching agents 20% (Pekaetch 20, Heraeus Kulzer GmbH) and 37,5% (Esticid - Gel, Heraeus Kulzer GmbH) phosphoric acid were applied for 7 or 15 sec.

After the etching time expired each sample was washed with water-air stream for 15 sec and dried with gentle scattered airflow at a distance of 20-25 cm for 5 sec. The prepared samples were left at room temperature for 24 hours in separate sterile petri dishes for each group to avoid contamination before the SEM observation.

Control samples. One tooth from each dentition was not etched after the removal of enamel and dentin from the vestibular surface in order to be used as a control sample.

Development of SEM images. Ten SEM images were taken of each sample at magnifications of 1,500 from a zone with dimensions of 114μm \ 35.2μm in the central part of the vestibular surface of the researched object. The analysis of all 420 SEM images served for evaluation of the etching effect for each sample.

The criteria for assessing the cleaning effect of the acids are:

- Degree of removal of the smear layer by comparing the number of dentin tubules' orifices without plugs and those which are partially or completely obstructed from smear layer on each image;
- Presence of a smear layer within the intertubular dentin - presence of precipitates and deposits on the surface of the intertubular dentin.

The cleaning effect is measured in percentages – as a ratio between the number of uncleaned (fully or partially obstructed by a smear layer) tubules and the whole amount of tubules in each image.

For a statistical measuring of the results single-variate (One-way ANOVA) and multivariate (MANOVA) dispersion analysis for comparison of quantifiable indicators in more than two groups and assessment of the combined impact of several factors were used. PostHocMultipleComparison test after establishing a statistically significant difference between the groups for analyzing the differences in pairs - packet SPSS 19 was also used.

RESULTS

Control samples

Dentin control samples without etching indicated a smear layer in both types of teeth – primary and permanent (figure 1).

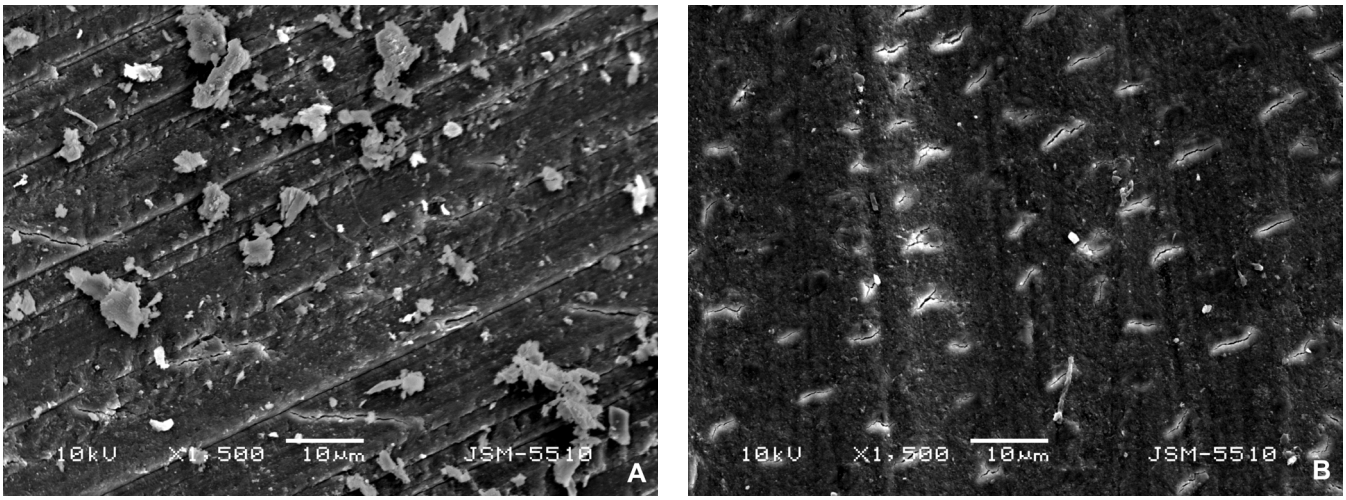


Fig. 1. Representative SEM images of a smear layer on the dentin surface of a primary (A) and a permanent (B) tooth.

The non-etched dentin surface was covered with a smear layer with identical characteristics in both types of samples. The smear layer could be seen as a veil that covers the treated dentin surface. The inherent microcanal structure of the dentin cannot be seen. In some places the smear layer was cracked. Visible cracks, which probably correspond to the entrances of the dentin tubules, could be observed. The surface of the smear layer was scattered with particles with irregular shapes and different sizes which were visibly not well attached to it.

When 20% phosphoric acid was applied the following results were observed:

Groups 1 and 2 - 20% phosphoric acid for 7 seconds

The etching of the dentin surface in the two groups - primary and permanent teeth, breaks, but does not completely remove the smear layer (figure 2).

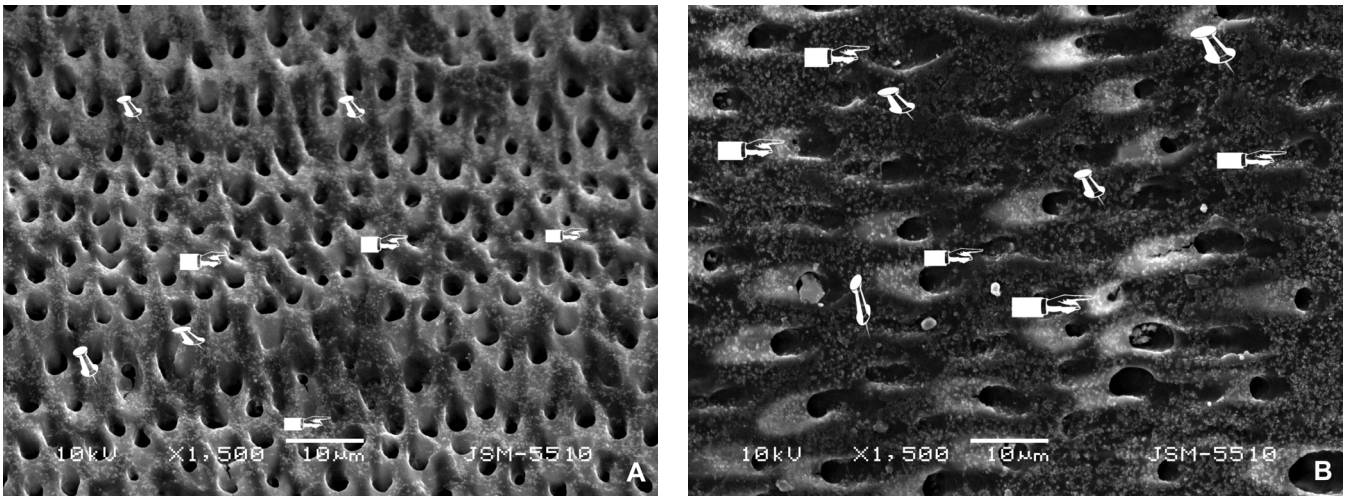


Fig. 2. Representative SEM images of dentin surface of a primary (A) and permanent (B) tooth etched with 20% phosphoric acid for 7 seconds. A preserved smear layer on the intertubular dentin can be observed.

The smear layer was removed primarily over the dentin tubules and preserved over the intertubular dentin (pins, fig. 2A and B). In some places some of the dentin tubules orifices were not exposed. That's why the number of opened dentin tubules was smaller than their real quantity. Many of them remain obscured from the smear layer (pointer fig. 2A and B).

Groups 3 and 4 - 20% phosphoric acid for 15 seconds

The results in group 3 primary and group 4 permanent teeth with increased etching time of 15 sec are similar to the previous ones. Some of dentin tubules remain by par-

tially or completely obscured by smear plugs (pointer fig. 3). In both groups residues from the smear layer and precipitates within the intertubular dentin are observed (pins - fig. 3A and B).

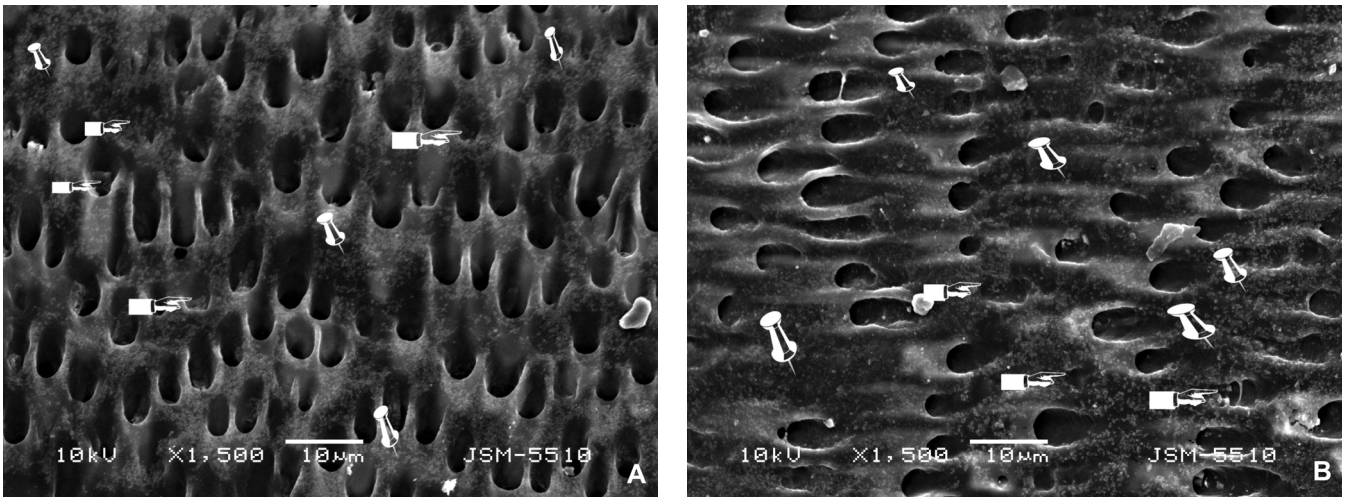


Fig. 3. Representative SEM images of dentin surface of a primary (A) and permanent (B) tooth which was etched with 20% phosphoric acid for 15 sec. There were residues of a smear layer (pins) and single, dentin tubules that are obscured with smear layer plugs (pointer).

Dentin tubules in Group 3 which were obscured with smear plugs were rarely observed when comparing the results between Group 1 and Group 3a (figure 2 and figure 3), but remnants of the smear layer and precipitates on the intertubular dentin were preserved. The results are similar in the groups of permanent teeth - 2 and 4. Uncleaned dentin tubules in group 4 were more rarely observed, but still remnants of smear layer on the intertubular dentin in both groups (fig. 2B and fig. 3B) could be seen.

The following results when applying 37,5% phosphoric acid were observed:

Groups 5 and 6 – 37,5% phosphoric acid for 7 seconds

A fully removed smear layer of the intertubular dentin and of the dentin tubules' orifices can be observed in the tested primary teeth from group 5 (fig. 4A). In the permanent teeth from Group 6 precipitates and residues of the smear layer on the intertubular dentin surface can still be observed (pins, fig. 4B). There are also remnants of plugs in the orifices of the dentin tubules (fig. 4B pointer).

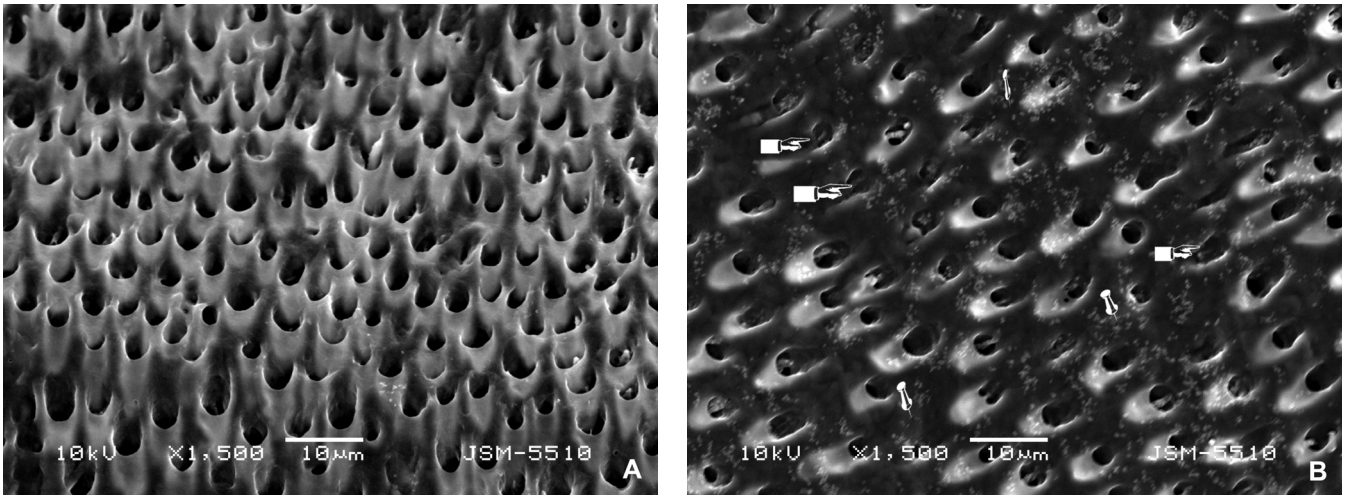


Fig. 4. Representative SEM images of dentin surface which was etched with 37,5% phosphoric acid for 7 seconds at a primary (A) and a permanent (B) tooth. Dentin surface that is clear of smear layer is established (figure 4A) and single plugs in the dentin tubules (pointer and residues from a smear layer on the intertubular dentin in permanent teeth (figure 4b - pins).

Groups 7 and 8 – 37,5% phosphoric acid for 15 seconds

In the group of permanent teeth (Group 8), we observe a clean of a smear layer and plugs dentin surface as well as a lack of precipitates after 15 seconds of etching with 37,5% phosphoric acid (fig. 5B).

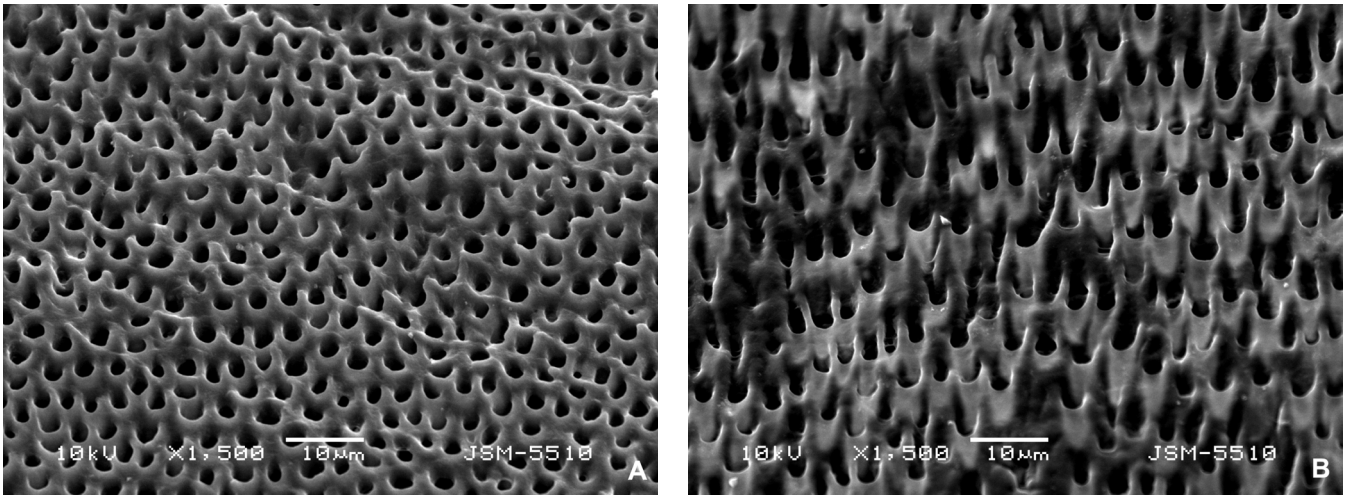


Fig. 5. Representative SEM images of a dentin surface of a deciduous (A) and a permanent tooth (B) - 15 sec, 37,5% acid.

In primary teeth (group 7) there is no difference in the quality of cleaning of the dentin surface as compared to the samples from group 5 (fig. 4A) It is again observed that the smear layer is completely removed from the intertubular dentine and the dentin tubules orifices are opened. It is noteworthy that the result of cleaning of the primary teeth which were etched with 37,5% acid for 7 seconds is the same as the one with the extended time for etching (fig. 5).

Statistical analysis

Table 2 presents the total number of tubules and the uncleaned ones of all samples from the different groups. Statistical analysis was made for the evaluation of the cleaning effect of the two acids concentrations in both dentitions.

Table 2. Number of present uncleaned tubules after etching with a different percentage of phosphoric acid.

Time / Tooth type	Number of samples	Number of SEM images	20% phosphoric acid		37,5% phosphoric acid	
			Total number of tubules	Number of uncleaned tubules	Total number of tubules	Number of uncleaned tubules
7 sec. Primary tooth	n = 5	50	8699	905	8885	4
7 sec. Permanent tooth	n = 5	50	10095	884	10183	328
15 sec. Primary tooth	n = 5	50	8894	131	8951	-
15 sec. Permanent tooth	n = 5	50	10194	154	10018	-

The cleaning effect is measured in percentage as the ratio between the number of uncleaned (fully or partially obscured of smear layer) tubules to the total number of tubules on the respective SEM images.

In all groups tested for etching with phosphoric acid 20%, a statistically significant difference ($p < 0.0001$) was detected. When etched for 7 sec (group 1) the share of uncleaned dentine tubules is 10.43%. By increasing the etching time to 15 sec (group 3) the share of uncleaned tubules is 1.48%. The smaller value of the share of uncleaned tubules means higher cleaning effect (table 3). In the group of permanent teeth that were etched for 7 sec the share of uncleaned dentin tubules from all SEM images from group 2 is 8.76%. When etched for 15 sec the share of uncleaned tubules in group 4 is 1.51%. Better cleaning effect is achieved when the etching duration was 15 sec (table 3).

Table 3. Uncleaned tubules in samples of primary and permanent teeth after etching with 20% phosphoric acid.

Group / Time for etching	Number of SEM images	Uncleaned tubules(%) mean±SE	T	P
Group 1 – 7 sec	50	10.43 ± 0.18	44.15	< 0.0001*
Group 3 – 15 sec	50	1.48 ± 0.10		
Group 2 – 7 sec	50	8.76 ± 0.18	62.47	< 0.0001*
Group 4 – 15 sec	50	1.51 ± 0.10		

**Statistically significant difference*

Table 4 shows the effect of etching time for the two groups of samples when etching with 20% acid is performed.

Table 4. Difference in number of uncleaned tubules in primary and permanent dentition at 7 and 15 sec of etching

Group Etching time	Number of SEM images	Uncleaned tubules (%) mean±SE	T	P
Etching for 7 sec				
Primary teeth	50	10.43 ±0.18	7.94	<0.001*
Permanent teeth	50	8.76±0.11		
Etching 15 sec				
Primary teeth	50	1.48 ±0.09	0.31	>0.05
Permanent teeth	50	1.51±0.03		

** Statistically significant difference*

The analysis of the influence of the type of tooth shows statistically significant difference in the proportion of uncleaned tubules between primary and permanent teeth, but only when etched for 7 sec (p <0.001). Etching for 15 sec shows no statistically significant difference (p> 0.05) (table 4).

A statistically significant difference was found in evaluating the combined impact of these two factors – etching time and type of teeth (permanent or primary) when 20% acid was used (table 5) (p <0.001). For this purpose a multivariate analysis (MANOVA) was used.

Table 5. Co-influence of the factors etching time and tooth type when etching with 20% phosphoric acid in reference to the share of uncleaned tubules (results of two-factor analysis).

Tooth type	Etching time	Uncleaned tubules (%)	Number of SEM images	Factor	F	p*
Primary	7 sec	10.43	50	Type of tooth	48.66	= 0.000
teeth	15 sec	1.48	50	Etching	4799.29	= 0.000
Permanent	7 sec	8.76	50	Type of tooth	52.68	= 0.000
teeth	15 sec	1.51	50	*Etching time		

**Empirical level of statistical significance (MANOVA)*

It was observed that there is a stronger cleaning effect in permanent teeth than that in primary ones with this acid concentration (table 5). The influence of the etching time is also statistically significant (p=0.000). When etching for 7 sec was used there was a lower cleaning effect. The co-influence was evaluated as statistically significant - the differences in the cleaning effect between primary and permanent teeth when etching for 7 sec are dissimilar to those when etching for 15 sec was applied - increasing the etching time 15 sec leads to a better cleaning result in the deciduous teeth - an opening of more dentin tubules (table 5).

The statistical processing of the data on the effect of cleaning of the 37,5% phosphoric acid for different times of exposure - 7 and 15 sec in the group of primary teeth (groups 5 and 7) showed no statistically significant difference (p> 0.05) (table 6). The increased etching time did not lead to better cleaning effect in the group of primary teeth - the results showed that 100% of the dentin tubules are cleaned with a 7 sec etching (table 6). The statistical analysis of the results under the same conditions for the group of permanent teeth (groups 6 and 8) showed a statistically significant difference in the effect of cleaning for 7 sec and 15 sec (p <0.0001) (table 6).

Table 6. Uncleaned tubules in samples of primary and permanent teeth after etching with 37,5% phosphoric acid.

Group / Time for etching	Number of SEM images	Uncleaned tubules (%) mean±SE	T	P
Group 5 – 7 sec	50	0.04 ± 0.02	Mann Whitney	>0.05
Group 7 – 15 sec	50	0.00 ± 0.00	U test	
Group 6 – 7 sec	50	3.22 ± 0.14	22.2	< 0.0001*
Group 8 – 15 sec	50	0.00 ± 0.00		

**The difference is statistically significant*

When a 7 sec etching is applied, the share of uncleaned dentin tubu

les of all SEM images of Group 6 is 3.22%. When etching for 15 sec is applied the share of uncleaned tubules in group 8 is 0%. Better cleaning effect in the groups of permanent teeth was found at the 15 sec etching time. Longer etching results in achieving a cleaner dentin surface and fully opened dentin tubules (table 6).

A multivariate analysis (MANOVA) was used again for an assessment of the combined effect of the factors etching time (7 and 15 sec) and tooth type (primary or permanent) when using 37,5% phosphoric acid (table 7).

Table 7. Co-influence of the factors etching time and tooth type when etching with 37,5% phosphoric acid is applied in terms of the relative share of uncleaned tubules (results of a two-factor analysis).

Type of tooth	Etching time	Uncleaned tubules (%)	Numbers of SEM images	Factor	F	P*
Primary	7 sec	0.04	50	Tooth type	468.94	= 0.000
teeth	15 sec	0.00	50	Etching time	495.85	= 0.000
Permanent	7 sec	3.22	50	Tooth type	468.94	= 0.000
teeth	15 sec	0.00	50	*Etching time		

**Empirical level of statistical significance (MANOVA)*

The results of the influence of the tooth type factor show a statistically significant difference (p = 0.000). In permanent teeth a weaker cleaning effect was observed. The effect of the etching time was also statistically significant. When etching for 7 sec was applied a weaker cleaning effect in the permanent teeth is observed. The co-influence of the two factors – etching time and tooth type was also assessed as statistically significant – the differences in the cleaning effect between primary and permanent teeth during etching for 7 sec had different levels compared to these which were etched for 15 sec. The results show a significant difference in cleaning effect on the teeth types that were etched for 7 sec and show insignificant difference when etching for 15 sec was performed (table 7).

A multivariate analysis (MANOVA) was also performed in order to assess the combined impact of all the above mentioned factors - tooth type, etching time, etching agent concentration (table 8). Therefore a model is applied including all factors and studying their impact on the share of uncleaned tubules.

Table 8. Co-influence of the factors etching time, tooth type and acid concentration in reference to therelative share of uncleaned tubules (results of MANOVA).

Type of tooth	Concen-tration	Etching time	Uncleaned tubules (%)	Number of SEM images	Factor	F	P*
Primary teeth	20%	7sec.	10.43	50	Type of tooth	31.42	= 0.000
		15sec	1.48	50			
	Average value for 20% concentration		5.95	100	Concentration	4691.34	= 0.000
	37,5%	7 sec.	0.04	50	Etching time	4972.10	= 0.000
		15 sec.	0.00	50			
	Average value for 37,5% concentration		0.02	100	Type of tooth - Concentration	303.51	= 0.000
	Total for 20% and 37,5 % concentr.	7 sec.	5.24	100	Type of tooth - Etching time	28.80	= 0.000
		15 sec.	0.74	100			
					Concentration - Etching time	2193.52	= 0.000
Average value for primary teeth			2.99	200	Tooth type - Concentration	311.89	= 0.000
Permanent Teeth	20%	7 sec.	8.76	50	- Etching time		
		15 sec.	1.51	50			
	Average value for 20% concentration		5.14	100			
	37,5%	7 sec	3.22	50			
		15 sec	0.00	50			
	Average value for 37,5% concentation		1.61	100			
	Total for 20 and 37,5 % concentr.	7 sec	5.99	100			
		15 sec	0.76	100			
Average value for permanent teeth			3.37	200			
Total Primary Teeth + Permanent Teeth	20%	7 sec	9.59	100			
		15 sec	1.49	100			
	Average value for 20% concentration		5.54	200			
	37,5%	7 sec	1.63	100			
		15 sec	0.00	100			
	Average value for 37,5% concentration		0.82	200			
	Total for 20 and 37,5 % concentr.	7 sec	5.61	200			
		15 sec	0.75	200			
Average value for primary teeth + perm teeth.			3.18	400			

**Empirical level of statistical significance (MANOVA)*

The following statistically significant effects were obtained (p <0.0001, table 8):

1. One-dimensional effect:

a. Type of tooth – the share of uncleaned tubules is statistically significantly higher in permanent teeth - 3.37% compared to 2.99% for primary teeth;

b. Concentration – the share of uncleaned tubules is statistically significantly higher at 20% vs. 37,5% - respectively 5.54% compared to 0.82%;

c. Etching - the share of uncleaned tubules is statistically significantly higher at 7 sec than 15 sec - respectively 5.61% compared to 0.75%;

2. Two-dimensional effects – co- influence of two factors

a. Type of tooth and concentration - the share of uncleaned tubules in primary teeth is higher than the one in permanent teeth at a concentration of 20% (5.95% against 5.14%) and at a concentration of 37,5% this relation is reversed (0.02% for the primary against 1.61% for permanent teeth);

b. Type of tooth and etching - in the 7 sec etching a more notable difference between the share of uncleaned tubules for primary teeth and permanent teeth is observed (5.24% vs. 5.99%), whereas for the 15 sec etching this difference virtually disappears (0.74% vs. 0.76%);

c. Concentration and etching - the difference in the proportion of uncleaned tubules between the two concentrations with etching for 7 sec is significantly greater (9.59% with 20% acid as compared to 1.63% with the 37,5% acid) compared to the same difference between the two concentrations and etching for 15 sec (1.49% for 20% acid compared to 0.00% for 37,5% acid);

3. Three-dimensional effect – the co-influence of the three factors - it manifests itself by the absence of a statistically significant difference between etching 7 sec and 15 sec for primary teeth as cases of uncleaned tubules at 37,5% concentration (table 6) and the existence of such in permanent teeth (table 6). The corresponding difference at 20% concentration were confirmed as statistically significant (table. 3).

The cleaning effect is increased with increasing of the concentration and the etching time as the manifestation is different depending on the type of tooth - primary or permanent.

DISCUSSION

Our study aimed to trace the micromorphological features of the etched dentine as a substrate for adhesion. There were significant differences in the effect of etching agents on the dentin in the process of removing the smear layer. They showed that the application of phosphoric acid of varying concentrations and for different time causes the receiving of dentine substrate which is different for the teeth from the two dentitions.

After any cutting of the tooth surface a smear layer is formed. This layer contains the basic components of the enamel, inter- and peritubular dentin, including dentin tubules' content, mixed with water, microorganisms, toxins, enzymes, saliva. This layer may vary in composition, thickness, density and degree of binding to the underlying tooth structure, depending on the location of the preparation [37-43]. When a preparation of the dentin surface is performed, the dentin tubules are cut and therefore obscured by small plugs of this layer, which will lead to reduction of dentin permeability [44-46]. The smear layer can't be removed by washing with water, but it is subject to dissolution in a total etching [3, 15]

The results of our study show that the reactivity of the dentin of the primary teeth against an acid impact is different from the one of the permanent teeth (Table. 3, 6, 8), which is in confirmation of the results obtained by other researchers [15, 16, 26, 31, 47]. This rejected our working assumption that there are no differences in the dentin in the teeth of both dentitions.

The removal of the smear layer is related to the acid concentration used and the time of contact with the dentin surface [14, 15, 18, 21, 26, 48]. It is what our results reflected in the tables 3 to 8 showed.

The conclusion that can be drawn on the basis of our study is that the 20% phosphoric acid applied for two different etching times did not create dentin surface cleaned from a smear layer. Better cleaning effect is found in samples from permanent teeth (table 4). In primary teeth (fig. 2A) this smear layer is slightly affected. This is probably due to the formation of a thicker smear layer which may be associated with the presence of a larger amount of organic matter in the primary teeth, which is more resistant to the acid etching. The presence of residues from the smear layer and precipitates on the dentin surface probably will lead to unsatisfactory adhesion of the interface between the dentin and the hybrid layer which is a mediator in adhesion. Obscuring of dentin tubules with smear plugs will not allow the entry of a bonding agent and the formation of adhesive tags that are also contributing to the bond strength. Overall, this can be a reason for an adhesion failure. Therefore, the existing smear layer will hinder the primer and the bond from the adhesive system to carry out their purpose.

The 37,5% phosphoric acid that is used for dentin surface etching removes the smear layer in primary teeth much faster than in permanent teeth (p <0.0001, table 6 and 7) [10, 16, 26, 31]. We found that the application of 37,5% phosphoric acid for 7 seconds on the primary teeth and for 15 seconds on the permanent leads to a complete removal of the smear layer, both from the orifices of the dentin tubules (table 6) and the areas of intertubular dentine in both groups of samples (figure 4A and fig. 5B). The results from the multi-factorial analysis for assessing the simultaneous effect of the etching time and acid concentration show that the cleaning effect rises with the increase of the concentration and the etching time as the manifestation varies depending on the type of tooth - primary or permanent (table 8). This led to the rejection of the second part of our working hypothesis - that the etching time and acid concentration has no influence on the degree of removal of the smear layer.

The different dentin reactivity from the two dentitions can be due to two reasons. We assume that one of the reasons for this could be the more pronounced buffering capacity of the dentin of permanent teeth and the consequent

possibility of self-limitation of the action of acids. Another possible reason is the difference in the number of dentin tubules [26]. According to the authors who defend the views about the smaller tubular concentration and the smaller diameter of dentin tubules – the dentin of the primary teeth exhibits also a lower permeability [10, 26]. The forthcoming biomorphosis of the pulp of deciduous teeth determines its reduced turgor, which can also have an impact. This leads to the assumption that the dentin of the primary teeth has a low surface moisture content, which leads to a change in the agent's etching effectiveness in the removal of the smear layer as they exhibit a more aggressive action on the dentin [18, 26].

The etching of the dentin surface even for a short time can lead to significant changes in the dentin structure. It must be efficient, not extensive [1, 5]. In extensive demineralization of the intertubular dentin the collagen fibers will collapse and the calcium phosphate crystals will precipitate and therefore a protective layer that may not be completely impregnated by the adhesive primer and monomer could be formed [5, 31]. The rate of adhesives infiltration in the demineralized dentin gradually reduces in the direction towards the base of the hybrid layer [5, 6, 49]. In this case the removed mineral matrix is not completely replaced by the primer as a more unstable area at the base of the hybrid layer is left, which becomes a potential route for micro- and nanoleakage, hydrolytic and enzymatic degradation and as a whole - a place of bonding failure [50, 51]. The dentin etching is of fundamental importance to the adhesion effectiveness [16, 21, 26]. The increased reactivity of the dentin of the primary teeth against etchants is the reason that some authors recommend the etching time for them to be cut in half, as compared to that of the permanent [11, 31, 52, 53] in order to avoid the possibility of a deeper demineralization and subsequent incomplete infiltration of the primer/adhesive to the collagen fibers, which will compromise the effectiveness of the adhesion [18, 25, 54, 55].

The results of the survey show that reducing the etching time for the primary teeth dentin to 7 sec instead of 15 sec, recommended by manufacturers for the impact to permanent teeth, leads to the creation of dentin substrate which is similar to that of permanent teeth in the case of using 37,5% phosphoric acid. This would reduce the possibility of unnecessary increase of demineralization, damage to the collagen fibers, concerns about their future impregnation with the adhesive system and therefore concerns about the bond strength with consequences such as micro- and nanoleakage and restoration failure.

The foregoing, together with the results of our study, gives a reason to assume that using the same clinical adhesive application protocol in primary and permanent teeth is probably the main reason for the primary teeth to show lower adhesive bond strength at laboratory tests and reduced durability of the aesthetic restorations in clinical conditions.

CONCLUSIONS:

When 20% phosphoric acid is applied a dentin substrate free of smear layer is not created for the etching time of 7 and 15 sec in both dentitions. Efficiently removed smear layer and no precipitates were observed in primary teeth after 7 seconds etching with 37,5% phosphoric acid. The time of application of the etching agent and its concentration determine the removal of the smear layer.

Clinical relevance:

The creation of dentin substrate in primary teeth with morphological characteristics similar to that of permanent teeth, can be achieved by reducing the etching time to 7 sec instead of 15 sec recommended by manufacturers and applied for permanent teeth when using the 37,5% phosphoric acid as etching agent.

REFERENCES:

1. Pashley DH, Tay FR, Breschi L, Tjäderhane L, Carvalho RM, Carrilho M, et al. State of the art etch-and-rinse adhesives. *Dent Mater.* 2011 Jan;27(1): 1-16. [PubMed] [CrossRef]

2. Eliades G, Watts DC, Eliades T. (Editors) Dental hard tissues and bonding. *Springer.* 2005, p. 3-33. [CrossRef], p. 89-122. [CrossRef]

3. Van Meerbeeck B, De Munck J, Yoshida Y, Inoue S, Vargas M, Vijay P. et al. Buonocore memorial lecture. Adhesion to enamel and dentin: current status and future challenges. *Oper Dent* 2003 May-Jun;28(3):215-235. [PubMed]

4. Van Meerbeek B, De Munck J, Mattar D, Van Landuyt K, Lambrechts P. Microtensile bond strengths of an etch and rinse and self-etch adhesive to enamel and dentin as a function of surface treatment. *Oper Dent.* 2003 Sep-Oct;28(5):647-660. [PubMed]

5. Eick JD, Gwinnett AJ, Pashley DH, Robinson SJ. Current Concepts on Adhesion to Dentin. *Crit Rev Oral Biol Med.* 1997;8(3):306-335. [PubMed] [CrossRef]

6. Cardoso MV, de Almeida Neves A, Mine A, Coutinho E, Van Landuyt K, De Munck J. et al. Current aspects on bonding effectiveness and stability in adhesive dentistry. *Austr Dent J* 2011 Jun;56(Suppl 1):31-44. [PubMed] [CrossRef]

7. Lenzi TL, Raggiob PR, Soaresc FZ, Rochad RdeO. Bonding Performance of a Multimode Adhesive to Artificially-induced Caries-affected Primary Dentin. *J Adhes Dent* 2015 Apr;17(2): 125-131. [PubMed] [CrossRef]

8. Bordin-Aykroyd S, Sefton J, Davies EH. In Vitro Bond Strengths of Three Current Dentin Adhesives to Primary and Permanent Teeth. *Dent Mater* 1992 Mar;8(2):74-78. [PubMed] [CrossRef]

9. Kilpatric NM. Durability of Restorations in Primary Molars. *J Dent* 1993 Apr;21(2):67-73. [PubMed]

10. Koutsi V, Noonan RG, Horner JA, Simpson MD, Matthews WG, Pashley DH. The effect of dentin depth on the permeability and ultrastructure of primary molars. *Pediatr Dent* 1994 Jan-Feb;16(1): 29-35. [PubMed]

11. Lenzi TL, Braga MM, Raggio DP. Shortening the etching time for etch-and-rinse adhesives increases the bond stability to simulated caries-affected primary dentition. *J Adhes Dent*. 2014 Jun;16(3):235-41.

[PubMed] [CrossRef]

12. Neves AA, Coutinho E, Cardoso MV, Lambrechts P, Van Meerbeek B. Current concepts and techniques for caries excavation and adhesion to residual dentin. *J Adhes Dent* 2011 Feb;13(1);7-22. [PubMed] [CrossRef]

13. Toba S, Veerapravati W, Shimada Y, Nikaido T, Tagami J. Micro-shear bond strengths of adhesive resins to coronal dentin versus the floor of the pulp chamber. *Am J Dent* 2003 Sep;16 Spec No:51-56. [PubMed]

14. Goes MF, Sinhoreti MA, Consanis S, da Silva. Morphological Effect of the Type, Concentration and Etching Time of Acid Solutions on Enamel and Dentin Surfaces. *Braz Dent J* 1998 ;9(1):3-10. [PubMed]

15. Puppin-Rontani RM, Caldo-Teixeira AS, Sinhoreti MA, Correr Sobrinho LC. Etching time evaluation on the shear bond strength of two adhesive systems in primary teeth. *Cienc Odontol Bras.* 2004; 7(3):6-14

16. Shashikiran ND, Gunda S, Subba Reddy VV. Comparison of resin-dentin interface in primary and permanent teeth for three different durations of dentin etching. *J Indian Soc Pedo Prev* Dent 2002 Dec;20(4):124-131. [PubMed]

17. Torres CP, Chinelatti MA, Gomes-Silva JM, Borsatto MC, Palma-Dibb RG. Tensile bond strength to primary dentin after different etching times. *J Dent Child (Chic).* 2007 May-Aug;74(2):113-117. [PubMed]

18. Wang Y, Spencer P. Effect of acid etching time and technique on interfacial characteristics of adhesive - dentin bond using differential staining. *Eur J Oral Sci* 2004 Jun;112(3):293-299. [PubMed] [CrossRef]

19. Courson F, Bouter D, Ruse ND, Degrange M. Bond strength of nine current dentine adhesive systems to primary and permanent teeth. *J Oral Rehabil* 2005 Apr;32(4):296-303. [PubMed] [CrossRef]

20. Johnson DC. Comparison of primary and permanent teeth. In *Oral Development and Hystology*. Avery JA. Editor - BC-Decker Philadelphia 1988, pp.180-190.

21. Nör JE, Feigal RJ, Dennison JB, Edwards CA. Dentin bonding: SEM comparison of the resin dentin interface in primary and permanent teeth. *J Dent Res.* 1996 Jun;75(6):1396-1403. [PubMed] [CrossRef]

22. Osorio R, Aguilera FS, Otero PR, Romero M, Osorio E, Garcýa-Godoy F, Toledano M. Primary dentin etching time, bond strength and ultrastructure characterization of dentin surfaces. *J Dent* 2010 Mar;38(3):222-231. [PubMed] [CrossRef]

23. Bolaños-Carmona V, González-López S, Briones-Luján T, De Haro-Muñoz C, de la Macorra JC. Effects of Etching Time of Primary Dentin on Interface Morphology and Microtensile Bond Strength. *Dental Materials* 2006 Dec;22(12):1121-1129. [PubMed] [CrossRef]

24. Hosoya Y. Hardness and elasticity of bonded carious and sound primary tooth dentin. *J Dent* 2006 Feb; 34(2):164-171. [PubMed] [CrossRef]

25. Hosoya Y, Marshall GW. The Nano-Hardness and Elastic Modulus of Sound Deciduous Canine Dentin and Young Premolar Dentin - Preliminary Study. *J Mat Sci Mat Med.* 2005 Jan; 16(1):1-8. [PubMed] [CrossRef]

26. Nör JE, Feigal RJ, Dennison JB, Edwards CA. Dentin Bonding: SEM Comparison of the Dentin Surface in Primary and Permanent Teeth. *Pediatr Dent.* 1997 May-Jun;19(4):246-252. [PubMed]

27. Berkowitz BKB, Holland GR, Moxham BJ. Oral Anatomy, Histology and Embriology. 3rd Edition, Mosby. 2002, p 102-116.

28. Angker L, Swain MV, Kilpatric N. Micro-mechanical characterization of the Properties of Primary Tooth Dentine. *J Dent.* 2003 May;31(4):261-267. [PubMed] [CrossRef]

29. Stalin A, Varma BR, Jayanthi. Comparative Evaluation of Tensile-Bond Strength, Fracture Mode and Microleakage of Fifth, and Sixth Generation Adhesive Systems in Primary Dentition. *J Indian Soc Pedod Prev Dent.* 2005 June;23(2):83-88. [PubMed] [CrossRef]

30. Sumikawa DA, Marshall GW, Gee L, Marshall SJ. Microstructure of primary tooth dentin. *Pediatr Dent.* 1999 Nov-Dec;21(7):439-444. [PubMed]

31. Sardella TN, de Castro FL, Sanabe ME, Hebling J. Shortening of Primary Dentin Etching Time and its Implication on Bond Strength. *J Dent.* 2005 May;33(5):355-362. [PubMed] [CrossRef]

32. Elkins CJ, McCourt JW. Bond Strength of Dentin Adhesives in Primary Teeth. *Quintessence Int.* 1993 Apr;24(4):271-273.

33. Mahoney E, Holt A, Swain M, Kilpatric N. The hardess and modulus of elasticity of primary molar teeth: an ultra-micro-indentation study. *J Dent.* 2000 Nov;28(8):589-594. [PubMed] [CrossRef]

34. Suzuki M, Kato H, Wakumoto S. Vibrational Analysis by Raman Spectroscopy of the Interface between Dental Adhesive Resin and Dentin. *J Dent Res.* 1991 Jul;70(7):1092-1097. [PubMed] [CrossRef]

35. Marquezan M, da Silveira BL, Burnett LH Jr, Rodrigues CR, Kramer PF. Microtensile bond strength of contemporary adhesives to primary enamel and dentin. *J Clin Pediatr Dent.* 2007 Winter;32(2):127–132. [PubMed]

36. Soares FZ, Rocha Rde O, Raggio DP, Sadek FT, Cardoso PE. Microtensile bond strength of different adhesive systems to primary and permanent dentin. *Pediatr Dent.* 2005 Nov-Dec;27(6):457-462. [PubMed]

37. Ayad MF, Rosenstiel SF, Hassan MM. Surface roughness of dentin after tooth preparation with different rotary instrumentation. *J Prosthet Dent.* 1996 Feb;75(2):122-28. [PubMed] [CrossRef]

38. Martinez-Insua A, Da Silva Dominguez L, Rivera FG, Santana-Penin UA. Differences in bonding to acid etched or Er:YAG laser treated enamel and dentin surface. *J Prosthet Dent.* 2000 Sep;84(3):280-288. [PubMed] [CrossRef]

39. Olmez A, Oztas N, Basak F, Erdal S. Comparison of the resin-dentin interface in primary and permanent teeth. *J Clin Pediatr Dent.* 1998 Summer;22(4):293-298. [PubMed]

40. Pashley DH, Tao L, Boyd L, King GE, Horner JA. Scanning electron microscopy of the substructure of smear layer in human dentine. *Arch Oral Biol.* 1988; 33(4):265-270. [PubMed] [CrossRef]

41. Tagami J, Tao L, Pashley DH, Hosoda H, Sano H. Effects of high-speed cutting on dentin permeability and bonding. *Dent Mater.* 1991 Oct;

7(4):234-239. [PubMed] [CrossRef]

42. Wang Y, Spencer P. Analysis of Acid-Treated Dentin Smear Debris and Smear Layers Using Confocal Raman Microspectroscopy. *J Biomed Mater Res*. 2002 May;60(2):300-308. [PubMed]

43. White GJ, Beech D, Tyas MJ. Dentin smear layer: an asset or a liability for bonding? *Dent Mater* 1989 Nov; 5(6):379-383. [PubMed] [CrossRef]

44. Cehreli ZC, Akca T. Effect of Dentinal Tubule Orientation on the Microtensile Bond Strength to Primary Dentin. *J Dent Child (Chic)*. 2003 May-Aug;70(2):139-144. [PubMed]

45. Pashley DH, Carvalho RM. Dentine Permeability and Dentine Adhesion. *J Dent* 1997 Sep;25(5):355-372. [PubMed] [CrossRef]

46. Pashley DH, Livingston MJ, Reeder OW, Horner J. Effects of the degree of tubule occlusion on the permeability of human dentin in vitro. *Arch Oral Biol*. 1978; 23(12):1127-1133. [PubMed]

47. Kaaden C, Powers JM, Friedl KH, Schmalz G. Bond strength of self-etching adhesives to dental hard tissues. *Clinic Oral Invest*. 2002 Sep; 6(3):155-60. [PubMed] [CrossRef]

48. Kaaden C, Schmalz G, Powers JM. Morphological Characterization of the Resin-Dentin Interface in Primary Teeth. *Clinic Oral Invest*. 2003 Dec; 7(4):235-240. [PubMed] [CrossRef]

49. Bouillaguet S. Biological risks of resin-based materials to the dentin-pulp complex. *Crit Rev Oral Biol Med*. 2004 Jan;15(1):47-60. [PubMed] [CrossRef]

50. Hashimoto M, Ohno H, Endo K, Kaga M, Sano H, Oguchi H. The effect of hybrid layer thickness on bond strength: demineralized dentin zone of hybrid layer. *Dent Mater*. 2000 Nov; 16(6):406-411. [PubMed] [CrossRef]

51. Sano H, Shono T, Takatsu T, Hosoda H. Microporous Dentin Zone beneath Resin-Impregnated Layer. *Oper Dent*. 1994 Mar-Apr;19(2):59-64. [PubMed]

52. Nakornchai S, Harnirattisai C, Surarit R, Thiradilok S. Microtensile bond strength of a total-etching versus self-etching adhesive to caries affected and intact dentin in primary teeth. *J Am Dent Assoc*. 2005 Apr;136(4):477-483. [PubMed]

53. Sattabanasuk V, Shimada Y, Tagami J. The bond of resin to different dentin surface characteristics. *Oper Dent*. 2004 May-Jun;29(3):333-341. [PubMed]

54. Assakawa T, Manabe A, Itoh K, Inoue M, Hisamitu H. Sasa R. Efficacy of dentin adhesives in primary and permanent teeth. *J Clin Ped Dent*. 2001 Spring;25(3):231-236. [PubMed]

55. Casagrande L, De Hipolito V, De Goes MF, de Araujo FB. Bond strength and interfacial morphology of two adhesive systems to deciduous dentin: in vitro study. *J Clin Pediatr Dent*. 2005 Summer;29(4):317-322. [PubMed]

Please cite this article as: Gateva N, Gusyiska A, Stanimirov P, Kabaktchieva R, Raichev I. Effect of etching time and acid concentration on micromorphological changes in dentin of both dentitions. *J of IMAB*. 2016 Apr-Jun;22(2):1099-1110. DOI: http://dx.doi.org/10.5272/jimab.2016222.1099

Received: 08/01/2016; Published online: 08/04/2016

Corresponding Author:
Assoc. prof. Natalia Gateva
Department of Pediatric Dentistry, Faculty of Dentistry, Medical University - Sofia,
1, St. George Sofiiski str., Sofia, Bulgaria
e-mail: nataliagateva@yahoo.de

SeniorCare2Share

Care about seniors? Have knowledge? Care to share?

QA

Quick Answer: How Much Phosphoric Acid Is In Coke

Table of Contents

So a can of Coke should have around 58mg × 3.16 = 183 mg of phosphoric acid.Fact #3: Cola has just as much

phosphoric acid as anti-nausea drugs do. Dose Sugar Phosphoric Acid Coke (one can) 39 g ~200 mg.

What percentage of phosphoric acid is in coke?

The main thing the graphic ignores here is the issue of concentration; the concentration of phosphoric acid in coke is very low (around 0.055%). Compare this to the acid content of an orange, which is around 1%, and it becomes clear that concern about Coke's acid content is being a little overblown.

Which soda has the most phosphoric acid?

AGD spokesman Kenton Ross said that RC Cola was found to be the most acidic soft drink studied, with a pH of 2.387 (the pH scale ranges from 0 to 14 for most liquids, with 0 being the most acidic and 14 being the least acidic—or most alkaline).

How many grams of phosphoric acid is in coke?

The active acid in Coca-Cola Classic is phosphoric acid (H_3PO_4). The average amount per can of coke works out to 17mg per 100 mL of Coca-Cola. This gives an acidity of only 0.017%.

How much phosphorus is in 12 oz of coke?

A 12 oz. can of cola with caffeine contains the most with 37 mg of phosphorus, while the same size serving of diet cola with caffeine contains 32 mg.

Is phosphoric acid in Coke bad for you?

Phosphoric acid is dangerous if you come into contact with it as a chemical substance. The toxic fumes can irritate your skin, eyes, and respiratory system.

Does Coke contain carbonic acid?

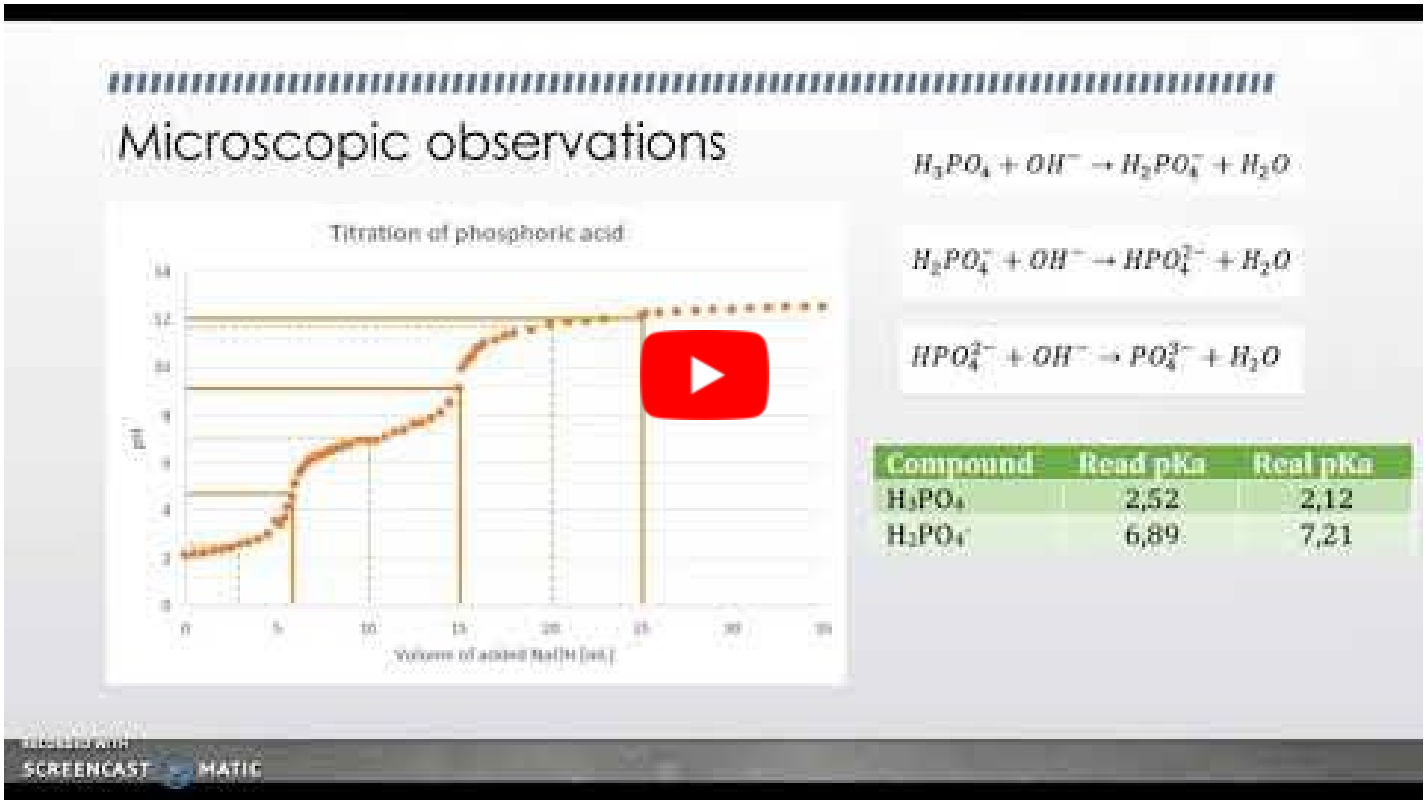
Soft drinks are carbonated. When you open a bottle of Coca-Cola, the carbonic acid starts separating back into water and carbon dioxide, the latter of which escapes the drink through bubbles. As it turns out, carbonic acid is not the problem. It is a relatively mild acid that has little to no effect on tooth structure.

Does Coke contain phosphoric acid?

Coke uses phosphoric acid in its flagship product as an acidulant to reduce micro-organism growth and to add tartness.

Why is Coca-Cola corrosive?

Message: Coca-Cola , like any other soft drink, is acidic. This is because a small amount of the carbon dioxide dissolved in soft drinks (to make them effervescent) will react in solution to form carbonic acid. Hydrochloric acid is much stronger than carbonic acid, and will dissolve an iron nail easily.



Does Coke Zero have phosphoric acid?

Diet sodas and tooth erosion One of the main ingredients in Coke Zero is phosphoric acid. Still, keep in mind that citric acid has been found to erode teeth more than phosphoric acid, which suggests that Coke Zero may affect tooth enamel slightly less than Diet Coke (13).

Why is Coke unhealthy?

An hour after drinking the beverage, a sugar crash will begin, causing irritability and drowsiness. “Regular consumption of these ingredients in the high quantities you find in Coke and other processed foods and drinks can lead to higher blood pressure, heart disease, diabetes, and obesity.

Is Coke alkaline or acidic?

How acidic is Coke? Its pH is reported to be 2.6 to 2.7, mainly due to H_3PO_4, phosphoric acid. As a fizzy drink, it contains plenty of dissolved carbon dioxide, but this makes very little contribution to the acidity.

Is phosphoric acid safe?

Phosphoric acid can be very hazardous in the case of skin contact, eye contact, and ingestion. It can also cause irritation if vapors are inhaled. This chemical can cause damage to the skin, eyes, mouth, and respiratory tract.

Why is phosphoric acid in Coke?

Phosphoric acid is deliberately added to soft drinks to give them a sharper flavor. It also slows the growth of molds and bacteria, which would otherwise multiply rapidly in the sugary solution. Almost all of the acidity of soda pop comes from the phosphoric acid and not from the carbonic acid from the dissolved CO_2.

Which sodas have phosphoric acid?

Coke, Pepsi and many other dark soft drinks use phosphoric acid for their sharp flavor and to extend shelf life. Clear soda usually uses citric acid for a similar taste and skips the phosphorus, so it’s a better choice for people looking to limit how much phosphorus they eat or drink.

How much phosphoric acid is in Pepsi?

The phosphoric acid content (mg P/L) in the three batches of these beverages using potentiometric method were: Light Coke – 136.9±5.9, 139.500±0, 139.500±0; Regular Coke – 183.4±3.9, 175.2±0.8, 174.4±2.3; Light Pepsi – 170.5±2.1, 172.8±3.6, 164.6±2.0; Regular Pepsi – 139.8±4.5, 141.6±3.1, 140.0±0.9; Smirnoff Ice -.

Does Red Bull have phosphoric acid?

No, ORGANICS by Red Bull products are made with ingredients from natural sources. Based on the USDA National Organic Program, organic products may not contain artificial flavors, artificial colors, preservatives or additives such as phosphoric acid.

Why phosphoric acid is bad for you?

* Phosphoric Acid can affect you when breathed in. * Phosphoric Acid is a CORROSIVE CHEMICAL and contact can irritate and burn the eyes. * Breathing Phosphoric Acid can irritate the nose, throat and lungs causing coughing and wheezing.

DHBC
Dental Hygiene
Board of California

Saturday, April 23, 2022

Dental Hygiene Board of California

Agenda Item 5

Future Agenda Items

Saturday, April 23, 2022

Dental Hygiene Board of California

Agenda Item 6

Closed Session – Full Board

The Board may meet in Closed Session to deliberate on disciplinary matters pursuant to Government Code section 11126, subdivision (c)(3). If there is no closed session at this meeting, it will be announced.

DHBC
Dental Hygiene
Board of California

Saturday, April 23, 2022

Dental Hygiene Board of California

Agenda Item 7

Adjournment.