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RESEARCH AND EDUCATION

Gingival displacement: Survey results of dentists' practice procedures

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ABSTRACT

Statement of problem. A high percentage of fixed prosthodontic restorations require a subgingival margin placement, which requires the practice of gingival displacement or a deflection procedure to replicate the margins in impression.

Purpose. The purpose of this study was to learn the different gingival displacement techniques that are currently used by dentists in their practice and to compare the current concepts of gingival displacement with previously published articles.

Materials and methods. A survey of questions pertaining to gingival deflection methods was distributed as part of continuing education (CE) course material to dentists attending CE meetings in 7 states in the U.S. and 1 Canadian province. Question topics included initial patient assessment procedures, gingival displacement methods, dentist's knowledge and assessment of systemic manifestations, and brand names of materials used.

Results. Ninety-four percent of the participants were general practitioners with 24.11 ±12.5 years of experience. Ninety-two percent used gingival displacement cords, while 20.2% used a soft tissue laser and 32% used electrosurgery as an adjunct. Sixty percent of the dentists used displacement cords impregnated with a medicament. Of the preimpregnated cords, 29% were impregnated with epinephrine, 13% with aluminum chloride, and 18% with aluminum potassium sulfate.

Conclusion. The study showed a steady decrease compared with results of previously published articles in the use of epinephrine as a gingival deflection medicament. (J Prosthet Dent 2015;114:81-85)

In 1985, a survey was conducted of 495 dentists to determine the most common protocols for gingival displacement before making impressions for indirect restorations.[1] The survey found that most dentists used gingival displacement cords soaked in a hemostatic medicament for the majority of impressions. The survey found that the most commonly used hemostatic medicament was racemic epinephrine. Seventy-nine percent of dentists indicated that this was their medicament of choice. These results were similar to those of a previously published study.[2] A subsequent survey showed the use of epinephrine had dropped to 25%. However, this latest survey was limited to prosthodontists and may not reflect use by general practitioners.[3]

The 1985 article included a detailed discussion on epinephrine and its potential absorption into the bloodstream and possible negative adrenergic effects. The authors further speculated that the use of epinephrine-soaked cords with multiple tooth preparations could have serious consequences for "cardiac" patients and provided evidence that determining which patients are at increased risk is often difficult.

Other authorities have also warned of the risks of using epinephrine-soaked cords.[4] As a result, many new materials have appeared on the market to facilitate impression making, the most popular being the cordless techniques.[5-9]

Impressions sent to commercial dental laboratories for the fabrication of indirect restorations also frequently fail to accurately record the prepared cervical margin and incorporate many errors in technique that might compromise the accuracy of the restoration.[10,11] Unpublished data from a master's thesis being conducted at the University of North Carolina's

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Clinical Implications

Potential systemic problems could occur with the use of epinephrine for gingival displacement procedures. Although no serious long-term effects were reported, dentists indicated that increased blood pressure, palpitations, and anxiety were common side effects with gingival displacement procedures.

Department of Operative Dentistry have determined that 55% of 1070 impressions sent to 3 major dental laboratories failed to completely capture the cervical margin of prepared teeth (personal communication: Dr C. Rau). Photographs obtained from different commercial laboratories of impressions that failed to accurately record the prepared cervical margin are shown in Figure 1.

Proper soft tissue management, including effective gingival displacement techniques, are critical to successful impression making.[12-14] Because of the documented poor quality of impressions sent to commercial dental laboratories and the introduction of many new techniques for gingival displacement, this study attempted to determine what procedures general dentists use for gingival displacement and to determine what changes have occurred since the publication of the original article in 1985.

MATERIAL AND METHODS

The proposal for the study was submitted to the North Carolina University Institutional Review Board approval process (IRB# 13-2120) and was determined as Non-Human Subject Study (NHSR). Dentists attending continuing education seminars in 7 states (North Carolina, South Carolina, Nebraska, Arizona, Utah, New York, Massachusetts) and 1 Canadian Province (Ontario) were asked to complete a 2-page questionnaire during the seminar (Supplemental Fig. 1). A total of 696 dentists completed the questionnaire. The questions in the survey inquired about initial patient assessment procedures, various gingival displacement methods, and type of displacement method currently used in their practice. The dentists' knowledge and assessment of systemic manifestations, such as increased heart rate and blood pressure, syncope, palpitation, and cardiac arrest, was also determined. Descriptive statistical analysis was used to assess the percentage of respondents in each category.

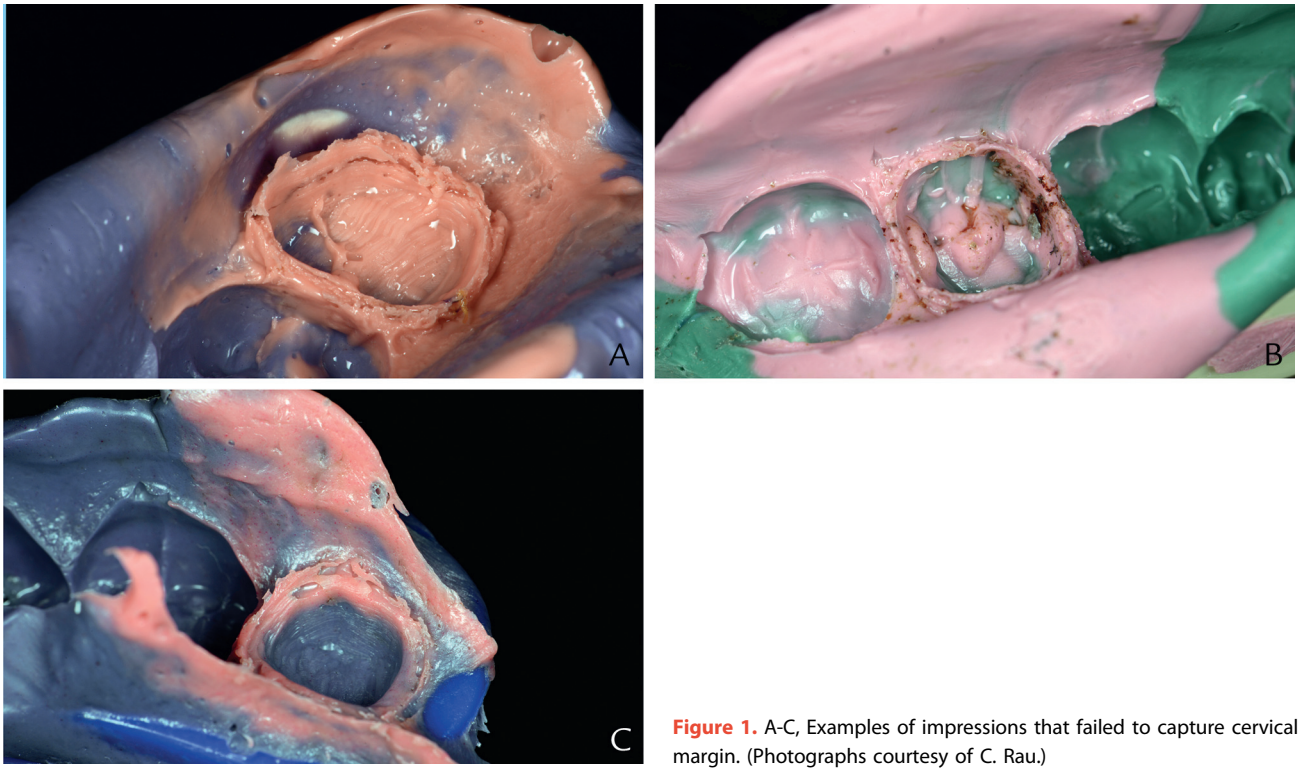

Figure 1. A-C, Examples of impressions that failed to capture cervical margin. (Photographs courtesy of C. Rau.)

Table 1. Brands of gingival displacement cords used by dentists who participated in survey

Name of Product	Manufacturer	No. of Users	Cumulative
Ultrapak	Ultradent Products	283	44.5%
Gingibraid*	DUX Dental	102	16.0%
Gingipak Original*	GingiPak	89	14.0%
Hemodent Retraction Cord	Premier Dental Products	73	11.5%
Ultrapak E†	Ultradent Productsc	40	6.3%
Gingipak Z-Twist*	GingiPak	38	5.6%
Racord†	Pascal International	28	4.4%
Unibraid*	DUX Dental	18	2.6%
Pascord	Pascal International	17	2.7%
Premier Retraction Caps	Premier Dental Products	9	1.4%
SilTrax EPI†	Pascal International	9	1.4%
GingiKNIT*	Van R	8	1.3%
Gingiplain	GingiPak	7	1.1%
Gingicap	Centrix	5	0.8%
SilTrax Plain	Pascal International	4	0.6%
SilTrax AS	Pascal International	3	0.5%
SilTrax Plus†	Pascal International	3	0.5%
Retrax	Pascal International	3	0.5%
Knit Trax	Pascal International	2	0.3%
Knit-Pak	Premier Dental Products Company	2	0.3%
Ultrax*	Sultan Healthcare	1	0.1%
Other	Brand not specified	32	5.0%

*Cords preimpregnated with epinephrine.
†Different variations of brand may contain epinephrine.

Table 3. Additional hemostatic agents used as infuser and their frequency of use

Medicament Used for Infusion	Manufacturer	No. of Users	Cumulative
Astringedent	Ultradent Products, Inc	104	14.9 %
Hemostasyl	Kerr Corporation	4	0.6%
Astringedent X	Ultradent Products	13	1.9%
Racegel	Septodont	3	0.4%
Viscostat/VicoStat Wintermint	Ultradent Products	69	9.9%
ViscoStat Clear	Ultradent Products	92	13.2%
Stat-Gel	Pascal International	1	0.1%
Racellet*	Pascal International	2	0.3%
Quick-Stat FS	Vista Dental Products	3	0.43%
Hemodettes	DUX Dental	5	0.7%
BloodStop iX	LifeScience Plus	1	0.1%
Pro Options Clear	Oratech, LLC	0	0.0%
Epidri hemostatic pellets*	Pascal International	5	0.7%
Other	Brand not specified	22	3.2%

*Products containing epinephrine as an active component.

RESULTS

Ninety-four percent of the participants were general practitioners with 25 ±12.9 years of experience. Items that were reported as part of a routine examination in their practice included a dental history (94%), medical history (96%), pulse rate (24%), blood pressure (37%), oral cancer examination (91%), and periodontal evaluation (90%).

Table 2. Types of medicaments used for soaking cord among reporting dentists

Type of Medicament	Manufacturer	No. of Users	Cumulative
Hemodent	Premier Dental Products	321	46.1%
Styptin	DUX Dental	7	1%
Orostat*	GingiPak	2	1.3%
FS Hemostatic Epinephrine Free Liquid	Premier Dental Products	14	2%
Hemogin L	DUX Dental	10	1.4%
Gingaid solution	GingiPak	5	1.9%
Racestyptine	Septodont	1	0.7%
Other	Brand not specified	65	9.3%

*Products containing epinephrine as an active component.

Table 4. Brands of medicaments used by reporting dentists and their active component

Medicaments Used to Soak Cords	Active Component
Hemodent	Buffered aluminum chloride
Styptin	Aluminum chloride
Orostat hemostatic solution	DL epinephrine HCL
FS hemostatic epinephrine free liquid	Ferric sulfate
Hemogin L	Aluminum chloride
Gingaid hemostatic solution	Aluminum chloride
Racestyptine	Hexahydrated aluminum chloride
Medicaments Used for Infusion	**Active Component**
Astringedent hemostatic agent	15.5% Ferric sulfate
Hemostasyl	15% Aluminum chloride
Astringedent X	12.7% Iron solution containing equivalent ferric sulfate and ferric subsulfate
Racegel	Aluminum chloride
Viscostat/VicoStat Wintermint hemostatic agent	20% Ferric sulfate
ViscoStat Clear Hemostatic Agent	25% Aluminum chloride
Stat-Gel hemostatic gel	Ferric sulfate
Racellet	Racemic epinephrine hydrochloride
Quick-Stat FS	Ferric sulfate
Hemodettes	Aluminum chloride
BloodStop iX	Etherized regenerated cellulose
Pro Options Clear	Aluminum chloride
Epidri hemostatic pellets	Racemic epinephrine hydrochloride

Ninety-two percent of reporting dentists used gingival displacement cords, of which 61% were braided cord, 20% were knitted cord, and 18% were reported as unknown. Of the 696 participants, 691 indicated the specific brand of gingival displacement cords that they use. The most commonly used cords and their frequency of use among the participating dentists are listed in Table 1. Sixty-eight percent of reporting dentists used displacement cords soaked in a medicament. Only 1.3% of dentists reported using epinephrine as an active component. The different types of medicaments used to

Table 5. Products used in cordless technique to aid in gingival displacement

Product Name	Manufacturer	No. of Users	Cumulative Percentage
Expasyl	Kerr Corp	64	9.1 %
Traxodent	Premier Dental Products Company	81	11.6%
Magic Foamcord	Coltène/Whaledent	7	1 %
Dryz	Parkell	11	7.1%
3M ESPE displacement capsule	3M ESPE	12	1.7%
3M ESPE Astringent displacement paste	3M ESPE	10	1.4%
GingiTrac gingival retraction material	Centrix	7	1%
Other	Brand not specified	24	3.4%

soak the cords by the reporting dentists are listed in Table 2.

When preimpregnated cords were used, 29% of the dentists used cords impregnated with epinephrine, 13% used cords impregnated with aluminum chloride, and 18% used cords impregnated with aluminum potassium sulfate (alum). Some dentists also used an additional hemostatic agent in the form of an infuser to control bleeding. Only 1% of dentists reported using these infusers with epinephrine as an active component. The medicaments used in the infusion technique are listed in Table 3. The various brands of medicaments used by the reporting dentists and their active components are listed in Table 4.

Twenty-eight percent of participating dentists reported that they practiced a cordless technique, and the frequency/percentage of products used in the cordless technique, as per the survey, is listed in Table 5. None of the products used in the cordless technique by the reporting dentists contained epinephrine. A soft tissue laser was used by 20.2% of dentists and 32% used electrosurgery to aid in gingival displacement.

In response to the question on the assessment of systemic manifestations such as increased heart rate, blood pressure, syncope, palpitation, and cardiac arrest, the 3 most commonly reported symptoms were increased blood pressure (70%), palpitation (44%), and anxiety (44%).

DISCUSSION

The 1985 survey focused on medicaments used with displacement cords and was particularly interested in the use of epinephrine-impregnated displacement cords and the specific systemic manifestations that might have resulted from the use of epinephrine. That survey determined that 79% of dentists used epinephrine-impregnated displacement cords. The authors of that article warned of the potential systemic problems that could occur with the use of epinephrine for gingival displacement procedures and also suggested that equally effective materials were available with less potential for systemic side effects.

The present survey of 696 dentists found that the percentage of dentists using epinephrine was substantially smaller than reported in the 1985 survey, with only 31.3% of dentists indicating they used some type of epinephrine-impregnated material for displacement. This is a significant improvement, but, in the opinion of the authors, the number of dentists using epinephrine is still too high. Although no serious long-term effects were reported, dentists did indicate that increased blood pressure, palpitations, and anxiety were common side effects when completing gingival displacement procedures.

Also of note was the relatively low percentage of dentists routinely recording the blood pressure (37%) and pulse rate (24%) of their patients. It is also distressing to note that not all dentists are routinely conducting an oral cancer examination (91%) or periodontal evaluation (90%).

The cordless technique for gingival displacement was used by 28% of participating dentists. The survey did not determine whether this technique was used occasionally or routinely. The safety of these materials is not of concern, but the efficacy of these cordless materials has yet to be confirmed in clinical trials.

CONCLUSIONS

A high percentage of dentists (92%) continue to use gingival displacement cords and medicaments to expose the cervical margins of tooth preparations. The percentage of practitioners using epinephrine has decreased from 79% in 1985 to 31.3% in 2014. A significant number of practitioners (28%) reported using cordless techniques for gingival displacement.

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UNC SCHOOL OF DENTISTRY
Department of Operative Dentistry

Gingival Displacement Methods Survey

ID #: ☐☐☐☐

Instructions: Please write directly on the survey with a BLACK BALLPOINT PEN. We ask that you answer all the questions to the best of your ability. Read each question carefully and provide your most appropriate response. Choose only ONE response per question unless otherwise indicated. Fill in circles completely or fill in the boxes and blanks as needed. Write your answer as neatly as possible.

1. Length of time in practice: ☐☐ yrs

2. Are you a general dentist? ○ Yes ○ No

If no, please indicate specialty: ○ Prosthodontist ○ Oral Surgeon ○ Endodontist ○ Periodontist ○ Pediatric Dentist ○ Other (please specify) _____

3. Which of the following items are a part of your routine investigation? (Select ALL that apply)

○ Dental History ○ Medical History ○ Pulse rate ○ Blood pressure ○ Oral cancer exam ○ Periodontal evaluation

4. Do you use gingival retraction cord? ○ Yes ○ No (please skip to question #11)

If yes: a. Please select the product(s) used. (Select ALL that apply)

○ Ultrapak ○ Ultrapack E ○ Gingicap ○ Gingibraid ○ Unibraid ○ CrownPak
○ Gingipak Original ○ Gingipak Z-Twist ○ Gingiplain ○ Knit Trax ○ Pascord ○ Racord
○ Retrax ○ Sil-Trax AS ○ Sil-Trax EPI ○ Sil- Trax Plain ○ Sil-Trax Plus ○ Knit-Pak
○ Hemodent Retraction cord ○ Premier Retraction Caps ○ Sulpak ○ Ultrax
○ GingiKNIT ○ Other (please specify) _____

b. Please specify type of cord. ○ Knitted cord ○ Braided cord ○ Don't know

5. Do you soak cords in a medicament before packing? ○ Yes ○ No

If yes, please select the product(s) used. (Select ALL that apply)

○ Hemodent ○ Hemogin L ○ Styptin ○ Gingaid Solution ○ Orostat ○ Stasis
○ Retrax ○ Racestyptine ○ FS Hemostatic Epinephrine-Free liquid
○ Other (please specify) _____

6. Do you use a double cord technique? ○ Yes ○ No

If yes, how often do you use it ? ○ Routinely ○ Occasionally

7. Do you use the infusion technique (use of a hemostatic agent before packing cord)? ○ Yes ○ No

If yes: a. Please select the product(s) used. (Select ALL that apply)

○ Astringedent ○ Hemostasyl ○ Astringedent X ○ Racegel ○ ViscoStat/ ViscoStat Wintermint
○ ViscoStat Clear ○ BloodStop ○ Stat- Gel ○ Racellet ○ Quick-Stat FS
○ Hemodettes ○ BloodStop ix ○ Pro-Options Clear ○ Epidri hemostatic pellets
○ Gel Cord 25% AlSO4 Gel ○ Other (please specify) _____

b. How often do you use it ? ○ Routinely ○ Occasionally

8. Do you use pre-impregnated cords? ○ Yes ○ No

If yes, please select the medicament(s). (Select ALL that apply)

○ Aluminum potassium sulfate (Alum) ○ Aluminum Chloride ○ Epinephrine
○ Other (please specify) _____

9. Do you routinely wet the retraction cord before removal? ○ Yes ○ No

Supplemental Figure 1. Survey questionnaire on gingival displacement methods currently used among participating dentists.

Gingival Displacement Methods Survey - page 2 **ID #:**

10. **Do you use "cordless" techniques for gingival displacement?** ○ Yes ○ No

If yes, please specify brand name. (Select ALL that apply)

○ Expasyl ○ Traxaodent ○ Magic Foam Cord ○ Dryz ○ 3M-ESPE Retraction capsule
○ 3M ESPE Astringent Retraction Paste ○ GingiTrac Ginvival Retraction
○ Other (please specify) _____

11. **Have you ever had a patient experience any systemic manifestation as a result of gingival retraction procedure?** ○ Yes ○ No

If yes, please select appropriate symptoms (Select ALL that apply)

○ Increased pulse rate ○ Increased blood pressure ○ Syncope ○ Palpitation ○ Cardiac arrest
○ Cold sweat ○ Anxiety ○ Other (please specify) _____

12. **Do you use electrosurgery as an aid to gingival retraction?** ○ Yes ○ No

If yes, how often do you use it ? ○ Routinely ○ Occasionally

13. **Do you use soft tissue laser as an aid to gingival retraction?** ○ Yes ○ No

If yes, how often do you use it ? ○ Routinely ○ Occasionally

14. **What is the maximum number of teeth you would take impressions on at one time?** ☐☐

Estimate the average number of prepared teeth per impression ☐☐

15. **What impression material do you use for fixed prosthodontics? (Select ALL that apply)**

○ PVS light body ○ PVS medium body ○ PVS heavy body ○ Alginate ○ Alginate substitute
○ Polyether ○ Hydrocolloid ○ Other (please specify) _____

Supplemental Figure 1. (*continued*) Survey questionnaire on gingival displacement methods currently used among participating dentists.