A comparative evaluation of the effect of dentin desensitizers on the retention of complete cast metal crowns

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Abstract

Context: Desensitizers are used to reduce dentin hypersensitivity. They affect the surface texture of prepared dentin and may alter the retention of fixed restorations. Aims: The aim was to evaluate the effect of dentin desensitizers on the retention of complete cast metal crowns luted with glass ionomer cement. Subjects and Methods: Fifty freshly extracted human premolars were subjected to standardized tooth preparation (20° total convergence, 4 mm axial height) with a computer numerically controlled machine. Individual cast metal crowns were fabricated from a base metal alloy. Dentin desensitizers included none (control), a glutaraldehyde (GLU) based primer (Gluma desensitizer), casein phosphopeptide (CPP)-amorphous calcium phosphate (ACP) (GC Mousse), erbium, chromium: YSGG laser (Waterlase MD Turbo, Biolase) and Pro-Argin (Colgate Sensitive Pro-Relief desensitizing polishing paste). After desensitization, crowns were luted with glass ionomer cement and kept for 48 h at 37°C in 100% relative humidity. The samples were tested using a universal testing machine by applying a load at a crosshead speed of 0.5 mm/min. Statistical Analysis Used: Statistical analysis included One-way ANOVA, followed by the Scheffe post-hoc test with P < 0.05. Results: All dentin desensitizers showed significantly different values: Pro-Argin (4.10 Megapascals [Mpa]) < CPP-ACP (4.01 mpa) < GLU based primer (3.87 Mpa) < Virgin dentin (3.65 Mpa) < LASER (3.37 Mpa). Conclusions: On comparing the effect of prepared virgin dentin, GLU based primer, CPP-ACP, LASER and Pro-Argin on the retention of complete cast metal crowns luted with glass ionomer cement on prepared teeth, it can be concluded that Pro-Argin and CPP-ACP showed the best retention in this in vitro study.

Keywords: Dentin desensitizer, glass ionomer cement, retention

Introduction

Fixed prosthodontics has undergone revolutionary change from a technically oriented discipline to one requiring application of biological principles and evidence based dentistry. Fixed partial dentures can transform an unhealthy, unattractive dentition to a comfortable, functional occlusion with enhanced esthetics.[1]

In a fixed partial denture, abutment teeth need to be prepared to receive restorations and to provide support and retention for replacing missing teeth. In order to achieve adequate retention, resistance and thickness of the restoring material, around 1.5–2 mm of tooth structure needs to be removed.[2] Preservation of natural tooth structure has always been the primary goal of the dental profession. In an attempt to provide functional, mechanically sound and esthetic restorations, attention to comfort during and after the procedure has often been overlooked.[3] Preparation of vital teeth results in millions of dentinal tubules being exposed. Dentin permeability may cause damage to the underlying pulpal cells. This leads to an increased possibility of postoperative dentin hypersensitivity.[4]

Hypersensitivity pain caused is transient, once the stimulus is removed; the pressure within the tubule returns to normal, and the pain subsides. The methods of treatment of dentin hypersensitivity are the tubular occlusion, blockage of nerve activity or remineralization.[5] Bonding agents, varnish, fluoride treatment, calcium phosphate precipitation, oxalates, casein phosphopeptide (CPP)–amorphous calcium phosphate (ACP), LASER and Pro-Argin may be used as desensitizing agents.[5-8]

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Subjects and Methods

This study was conducted on 50 freshly extracted, healthy, noncarious human premolars. The selected teeth were rinsed, scaled, polished and subsequently placed in 0.2% thymol in a closed container; for disinfection. The teeth were mounted in a cylindrical acrylic fixture 3 cm in height and 1.5 cm in diameter. Each acrylic fixture was numbered for identification from 1 to 50. They were placed in artificial saliva. The computer numerically controlled milling machine was programmed to prepare each tooth of the following specific dimensions: 4 mm axial length, 20° convergence angle, flat occlusal surface and chamfer margin. As a result, identical tooth preparations were achieved of an average area of 58.8 mm². After preparation, the teeth were again stored in artificial saliva.

Five acrylic fixtures along with their respective prepared teeth were joined to each other using cyanoacrylate to form one unit. Cellophane and Spacer wax were adapted over the teeth. Autopolymerizing acrylic resin custom trays were fabricated over the prepared teeth for all 10 units. The custom trays were retrieved, the cellophane and spacer wax removed. Universal tray adhesive was applied in one thin layer on the entire inner surface of the tray and allowed to remain for 1 min. Accurate single step impressions with putty and light body polyvinyl siloxane, elastomeric material were made for all the teeth [Figure 1]. The elastomeric impressions were boxed and poured in die stone to approximately 1 cm thickness and allowed to set. The casts were retrieved after an hour and individual dies were made for each tooth. After the dies were completely dry, one coat of the die hardener was applied to each die, followed by three coats of die spacer to allow space (25 μ) for the luting agent. The die spacer was kept 1 mm short of the finish line to allow intimate adaptation of the wax pattern at the margins. A dip in wax method was used to fabricate the wax pattern of 1 mm thickness. On the center of the occlusal surface of the wax pattern, a 10 mm diameter ring made of uniform thickness of sprue wax was attached [Figure 2]. The ring would be cast in metal as part of the crown, which would enable testing of the samples on the Universal Testing machine. This procedure was followed for all the 50 dies.

Wax sprues and reservoirs were attached to the wax patterns and invested in phosphate bonded investment. Ringless casting procedure was carried out. The investment was placed in the burn out furnace. The burn out furnace raised the temperature to 930°C over 2½ h. Casting was carried out in nickel-chromium alloy in an induction casting machine following standardized casting procedure. After the casted investment were bench cooled, the castings were retrieved and cleaned using air-abrasion with 50 μ aluminum oxide particles. The castings were checked for their fit on their respective dies followed by finishing and polishing [Figure 3]. They were evaluated for adequate fit on the teeth using a stereomicroscope. Castings with discrepancies more than 120 μ were discarded. The procedure was repeated until all castings fit the prepared teeth adequately.

The 50 teeth in their acrylic fixtures were grouped into five groups of 10 teeth each.

Control
No desensitizing agent. The first group of 10 teeth were not treated with any desensitizing agent hence they had virgin dentin to which the crowns would be luted.

Glutaraldehyde
Glutaraldehyde (GLU) based primer (Gluma Desensitizer, Heraeus Kulzer). The second group of 10 teeth were rinsed with water and dried with gentle air spray. One coat of the GLU based primer was applied to the teeth using an applicator tip and allowed to act for 30 s. Then, the dentinal surface was dried with air spray. This procedure was repeated once again and then rinsed with water.
Casein phosphopeptide-amorphous calcium phosphate
Casein phosphopeptide-ACP (GC Tooth Mousse, Recaldent Tooth Mousse, GC). A pea sized amount of GC Mousse was applied evenly over the entire surface of the 10 teeth in the third group with a gloved finger. It was allowed to act for 3 min and then kept in contact with artificial saliva for 30 min by placing the teeth in a gauze piece soaked in artificial saliva.[22] After 30 min, the teeth were removed from the gauze and were ready for testing.

LASER: Erbium, chromium: YSGG laser (Waterlase MD Turbo, Biolase)
The laser was programmed to provide settings for treatment of dentin hypersensitivity: Wavelength 2,780 μ, 0.5 W potency, and 30 Hz frequency. The laser was applied from a distance of 5 mm perpendicular to the tooth surface. The laser was slowly moved along all the surfaces of the tooth for 15 s.[3,23] This cycle was carried out totally three times for 10 teeth of the fourth group.

ARG: Pro-Argin (Colgate Sensitive Pro-Relief in-office polishing paste)
A rotary rubber cup mounted in a contra-angle micromotor hand piece was filled with the paste which was dispensed in a dappen dish. The paste was burnished into each tooth for 3 s at a moderate speed of 30,000 rpm. The rubber cup was reloaded with paste, and this procedure was carried out three times and then rinsed with water.[24,25]

After desensitizing treatment of the teeth was carried out, the individual acrylic fixtures were separated. Prior to cementation, each prepared tooth in its acrylic fixture was placed in the base clamp of the Universal testing machine. The inner surface of each of the 50 cast metal crowns was coated with glass ionomer luting cement-GC Fuji I capsule in preweighed capsules mixed in an automated cement mixer and ejected from a GC Capsule Applier. Each casting was hand seated. After seating, the opposing shaft of the clamp of the universal testing machine was lowered, and a load of 5 kg was applied for a period of 10 min.[9] Excess set cement was removed from each casting margins with a straight probe. Varnish[26] was applied at the area of the luted margin with an applicator tip to prevent moisture contamination. All 50 samples with luted crowns were stored at 37°C at 100% relative humidity in a humidifier for 48 h before testing.[27]

The 50 ready samples were removed from the humidifier. Each sample was placed in the base clamp fastened on the universal testing machine. A hook was placed in the opposing clamp. Each sample was aligned such that the hook passed through the metal loop attached to the occlusal surface of the metal crown. A tensile load was applied at the cross-head speed of 0.5 mm/min and was increased till the crown was debonded.[28] The load values required to debond the crowns from each of the 50 samples were recorded, and stresses were calculated.

Results
The values obtained were in units of KgF (Kilogram Force) and were converted into Megapascals (MPa) using following formula:

\[
\text{Tensile stress} = \frac{\text{KgF} \times 9.81}{\text{Surface area of the prepared tooth (mm}^2\text{)}}
\]

Surface area of the prepared tooth (mm\(^2\))

There is one independent variable with five levels - Control, GLU based primer, CPP-ACP, Laser, and Pro-Argin. There is one dependent variable: Tensile stress (MPa). Hence, the comparisons between levels were made using One-way ANOVA. This was followed by Scheffe post-hoc test. Level of significance was \(P < 0.05\).

The mean tensile stress is highest for ARG (4.10 MPa), followed by CPP-ACP (4.01 MPa), GLU (3.87MPa), Control (3.65 MPa) and LASER (3.37 MPa).

The result of One-way ANOVA presented in Table 1 indicates that the mean tensile stress of at least one group differs significantly from one of the remaining groups [Figure 4]. Post-hoc Scheffe test in Table 2 shows that the mean tensile stress (MPa) for CPP-ACP and Pro-Argin are similar. Laser, Control, and GLU based primer are similar whereas, the mean tensile stress for Laser differs significantly.

![Boxplots for Tensile Stress (MPa) by Groups](image)

Figure 4: Statistical comparison of tensile stresses

| Source of variance | Sum of squares | df | Mean square | \(F\) | \(P\) |
|-------------------|---------------|----|------------|-----|-----|
| Between groups    | 3.48177       | 4  | 0.870      | 4.528 | 0.004 |
| Within groups     | 8.649594      | 45 | 0.192      |      |     |
| Total             | 12.13136      | 49 |            |      |     |

MPa: Megapascals
Table 2: Scheffe multiple comparisons between the mean tensile stresses (MPa)

| (I) Group | (J) Group | Mean difference (I-J) | SE  | P    | 95% CI          |
|-----------|-----------|-----------------------|-----|------|-----------------|
|           |           |                       |     |      | Lower bound     |
| Control   | GLU       | −0.22                 | 0.20| 0.87 | −0.85           |
|           | CPP-ACP   | −0.36                 | 0.20| 0.50 | −0.99           |
|           | Laser     | 0.28                  | 0.20| 0.73 | −0.35           |
|           | ARG       | −0.45                 | 0.20| 0.27 | −1.08           |
| GLU       | CPP-ACP   | −0.14                 | 0.20| 0.97 | −0.77           |
|           | Laser     | 0.50                  | 0.20| 0.19 | −0.13           |
|           | ARG       | −0.23                 | 0.20| 0.84 | 0.86            |
| CPP-ACP   | Laser     | 0.64*                 | 0.20| 0.04 | 0.01            |
|           | ARG       | −0.09                 | 0.20| 0.99 | 0.72            |
| Laser     | ARG       | −0.73*                | 0.20| 0.01 | −1.36           |

*The mean difference is significant at the 0.05 level. SE: Standard error; CPP-ACP: Casein phosphopeptide-amorphous calcium phosphate; GLU: Glutaraldehyde; MPa: Megapascals; CI: Confidence interval

Discussion

This study evaluated the effect of dentin desensitizers on the retention of complete cast metal crowns luted with glass ionomer cement. The average amount of force required to debond the crown per unit surface area (tensile stress) was the least for erbium, chromium (Er: Cr) YSGG Laser (3.37 MPa) and maximum for Pro-Argin (4.10 MPa). The mean values of tensile stresses in the study show that there is a significant difference in the effect of various dentin desensitizers on the surface of teeth prepared to receive complete cast metal crowns.

The comparative evaluation of the above materials is possible only with a clear protocol, which is discussed below. The major difference between previous studies was the ambiguty of standardization of tooth preparation. Various methods have been used for producing tooth preparations of exactly the same dimension. Johnson et al. used a parallel-sided diamond bur with a rounded tip to prepare the axial surfaces of the tooth (secured vertically in a jig) which was rotated against the diamond bur on a Ney’s surveyor base. Yim et al. used a custom-made pantograph. Sipahi et al. used a parallel preparation unit. The tooth preparation in this study was carried out by computerized numerical controlled milling. This ruled out human error that could have been caused in previous studies.

The teeth were prepared to simulate ideal clinical situation for mechanical adhesion. If teeth were prepared with the ideal 6° angle of convergence, the resistance to crown removal would increase significantly for any cement. This study assessed the effect of the dentin desensitizers on casting retention and did not confound the results by giving ideal convergence. Previous studies have used a restricted angle of convergence of 4.8, 6–10°, which alone provided significant casting retention. Hence a 20° angle of convergence was chosen for this study. In this manner, the contribution of the cement to retention of castings was better assessed.

The prepared teeth were stored in artificial saliva to simulate the natural environment of the teeth.

In order not to contaminate the surface of the prepared teeth, custom trays were fabricated over the teeth using cellophane sheet as a spacer. The impressions were made in a custom tray. The material used was polyvinyl siloxane due to its accuracy and ease of use. The impressions were poured in die stone and retrieved. After the wax patterns were fabricated, casting was done with the ringless procedure as it is deemed to be more accurate. The marginal fit of the metal castings was evaluated under the stereomicroscope and only well-fitting castings were used in the study.

The desensitizers used in this study have different modes of action and hence different effects on the dentin surface. Gluma desensitizer product contains 5% GLU and 35% hydroxyethyl methacrylate. The hypothesis for the immediate occlusion of the dentin tubules is an effect of GLU on the proteins of the dentinal fluid. In the reaction of GLU with dentin, the two groups of aldehydes present in GLU interlace themselves with the amino groups of dentin collagen, leading to a fixing of proteins, forming a barrier. Johnson et al. in 1998 concluded that the use of the GLU-based system as a desensitizing treatment for prepared teeth had no effect on crown retention for zinc phosphate, glass ionomer cement or resin cement. Yim et al. in 2000 concluded that use of a Gluma desensitizer significantly reduced crown retention strength when using a resin cement, glass ionomer, or zinc phosphate cement. In this study, the mean tensile stress is 3.87 MPa which is lower than Pro-Argin and CPP-ACP, and higher than the control and LASER.

Application of ACP and CPP in GC tooth mousse on dentine surfaces was able to reduce dentin sensitivity and enhance remineralisation of artificial-formed dentine lesions. The mechanism of this action may be the phosphopeptide casein and calcium phosphate components which stabilize...
calcium phosphate on tooth surface, thus maintaining a high concentration gradient of calcium and phosphate ions, promoting thus remineralization of hard tissues.[32-35] This study showed the tensile stress of CPP-ACP to be 4.01 MPa which is second only to Pro-Argin.

Sipahi et al.[6] in 2007 conducted a study, which concluded that if crown retention can be moderately sacrificed Laser would be a better option as a dentin desensitizer. Lasers have been recently proposed for the in-office treatment of dentin hypersensitivity and the exact mechanism of action not clearly understood. Middle-output-power lasers (Er: YAG, Nd: YAG, and Er, Cr: YSSG) may reduce or obliterate the dentinal tubules.[8] For Er: YAG and Er, Cr: YSSG, the efficacy in reducing dentin hypersensitivity is thought to be related to the thermo-mechanical ablation mechanism and to the high absorption of their wavelengths by water.[32-35] These effects may lead to the evaporation of the superficial layer of dentinal fluid, reducing the flow within the dentinal tubules. Lasers are also used for etching purposes at power of 1–2 W whereas for desensitizing purposes at 0.5 W.[36] Hence it may be possible that a variation in wattage may bring about better results than before.

Pro-Argin present in Colgate Sensitive Pro-Relief plays a role in naturally reducing dentin hypersensitivity. It has been shown to physically plug and seal exposed dentin tubules and to effectively relieve dentin hypersensitivity.[29] In this study, around 4.10 MPa was required to debond the crowns from the Pro-Argin treated teeth.

The luting agent used in this study was glass ionomer cement. Glass ionomer cement is a popular choice for luting metal restorations as it relies on mechanical retention to surface irregularities and chelation bond to tooth structure.[9,37]

This study is an in vitro study, hence the subjective desensitizing effect of the desensitizers on vital teeth can be determined only in a clinical situation. Glass ionomer cement has been used in this study. Resin modified glass ionomer cement and resin cement may be used in further studies.

There are many clinical implications of the results of this research. When using glass ionomer cement for luting cast metal crowns to prepared teeth treated with desensitizing agents, the amount of force required per unit area to debond the crown is Pro-Argin > CPP–ACP > GLU based primer > Er: Cr, YSSG LASER.

**Conclusion**

Prepared dentin treated with ErCr: YSSG laser (Waterlase MD Turbo) had the least retention of complete cast metal crowns luted with glass ionomer cement. Pro-Argin showed the best retention of complete cast metal crowns luted with glass ionomer cement compared to CPP-ACP, GLU based primer, virgin dentin and Laser. On comparing the effect of prepared virgin dentin, GLU based primer, CPP-ACP, LASER and Pro-Argin on the retention of complete cast metal crowns luted with glass ionomer cement on prepared teeth, it can be concluded that Pro-Argin and CPP-ACP showed the best retention in this in vitro study.

**References**

1. Shillingburg HT, Hobo S, Whit LD. Fundamentals of Fixed Prosthodontics. 2nd ed., ch. 1. Chicago: Quintessence Pub1 Co.; 1981.

2. Shillingburg HT, Hobo S, Whit LD. Fundamentals of Fixed Prosthodontics. 2nd ed., ch. 5. Chicago: Quintessence Pub1 Co.; 1981.

3. Krauser JT. Hypersensitive teeth. Part I: Etiology. J Prosthod Dent 1986;56:153-6.

4. Richardson D, Tao L, Pashley DH. Dentin permeability: Effects of crown preparation. Int J Prosthodont 1991;4:219-25.

5. Trushkovsky RD, Oquendo A. Treatment of dentin hypersensitivity. Dent Clin North Am 2011;55:599-608, x.

6. Sipahi C, Cehreli M, Ozen J, Dalkız M. Effects of precementation desensitizing laser treatment and conventional desensitizing agents on crown retention. Int J Prosthodont 2007;20:289-92.

7. Orchardson R, Gillam DG. Managing dentin hypersensitivity. J Am Dent Assoc 2006;137:990-8.

8. Sgolastra F, Petrucci A, Gatto R, Monaco A. Effectiveness of laser in dentinal hypersensitivity treatment: A systematic review. J Endod 2011;37:297-303.

9. Yim NH, Rueggeberg FA, Caughman WF, Gardner FM, Pashley DH. Effect of dentin desensitizers and cementing agents on retention of full crowns using standardized crown preparations. J Prosthodent 2000;83:459-65.

10. Arisu HD, Dalkiç E, Üçalis MB. Effect of desensitizing agents on the microtensile bond strength of a two-step self-etch adhesive to dentin. Oper Dent 2011;36:153-61.

11. Rahiotis C, Vougiouklakis G. Effect of a CPP-ACP agent on the retention in vitro study. J Dent 2007;35:695-8.

12. Leung VW, Darvell BW. Artificial salivas for in vitro studies of dental materials. J Dent 1997;25:475-84.

13. Ballint JO, Sicher H. Orbans Oral Histology and Embryology. ch. 5. United States of America: Mosby Publ Co.; 1966.

14. Franco EB, da Cunha LF, Herrera FS, Benetti AR. Accuracy of Single-Step versus 2-Step Double-Mix Impression Technique. ISRN Dent 2011;2011:341546.

15. Ahila SC, Subramaniam E. Comparative evaluation of dimensional stability and surface quality of gypsum casts retrieved from disinfected addition silicone impressions at various time intervals: An in vitro study. J Dent Oral Hyg 2012;4:34-43.

16. Andristsakis DP. The pindex system in the construction of removable dies. Odontostomatol Proodos 1990;44:427-36.

17. White SN, Yu Z. Film thickness of new adhesive luting agents. J Prosthodent 1992;2:782-5.

18. Mausner IK, Goldstein GR, Georgescu M. Effect of two dentinal desensitizing agents on retention of complete cast coping using four cements. J Prosthodent Dent 1996;75:129-34.

19. Campagni WV, Preston JD, Reisbick MH. Measurement of paint-on die spacers used for casting relief. J Prosthodent Dent 1982;47:606-11.

20. Duncan JD. The casting accuracy of nickel – chromium alloys for fixed prostheses. J Prosthodent Dent 1982;47:63-8.

21. Felton DA, Bergenholtz G, Kanoy BE. Evaluation of the desensitizing effect of Gluma Dentin Bond on teeth prepared for complete-coverage restorations. Int J Prosthodont 1991;4:292-8.
22. Kowalczyk A, Botulinski B, Jaworska M, Kierklo A, Pawinska M, Dabrowska E. Evaluation of the product based on Recaldent technology in the treatment of dentin hypersensitivity. Adv Med Sci 2006;51 Suppl 1:40-2.
23. Santos CR, Tonetto MR, Presoto CD, Bandeira MC, Oliveira OB Jr, Calabrese-Filho S, et al. Application of Er:YAG and ER, Cr: YSGG Lasers in cavity preparation for dental tissues: A literature review. World J Dent 2012;3:340-3.
24. Schiff T, Delgado E, Zhang YP, Cummins D, DeVizio W, Mateo LR. Clinical evaluation of the efficacy of an in-office desensitizing paste containing 8% arginine and calcium carbonate in providing instant and lasting relief of dentin hypersensitivity. Am J Dent 2009;22A: 8A-15.
25. Panagakos F, Schiff T, Guignon A. Dentin hypersensitivity: Effective treatment with an in-office desensitizing paste containing 8% arginine and calcium carbonate. Am J Dent 2009;22A: 3A-7.
26. Nicholson JW, Czarnecka B. Kinetic studies of the effect of varnish on water loss by glass-ionomer cements. Dent Mater 2007;23:1549-52.
27. Gemalmaz D, Yoruc B, Ozcan M, Alkumru HN. Effect of early water contact on solubility of glass ionomer luting cements. J Prosthet Dent 1998;80:474-8.
28. Heintze SD. Crown pull-off test (crown retention test) to evaluate the bonding effectiveness of luting agents. Dent Mater 2010;26:193-206.
29. Johnson GH, Lepe X, Bales DJ. Crown retention with use of a 5% glutaraldehyde sealer on prepared dentin. J Prosthet Dent 1998;79:671-6.
30. Lt Col Yadav RK. Marginal accuracy of castings produced with different investment systems. Med J Armed Forces India 2009;65:146-9.
31. Rosaiah K, Aruna K. Clinical efficacy of amorphous calcium phosphate, G.C. tooth mousse and gluma desensitizer in treating dentin hypersensitivity. Int J Dent Clin 2011;3:1-4.
32. Laura D. The effect of pro-arg in technology on patients with dentin hypersensitivity. Access 2012;1:10-3.
33. Hossain M, Nakamura Y, Yamada Y, Kimura Y, Matsumoto N, Matsumoto K. Effects of Er, Cr: YSGG laser irradiation in human enamel and dentin: Ablation and morphological studies. J Clin Laser Med Surg 1999;17:155-9.
34. Braun A, Jeppesen S, Deimling D, Ratka-Krüger P. Subjective intensity of pain during supportive periodontal treatment using a sonic scaler or an Er: YAG laser. J Clin Periodontol 2010;37:340-5.
35. Yilmaz HG, Kurtulmus-Yilmaz S, Cengiz E, Bayindir H, Aykac Y. Clinical evaluation of Er, Cr: YSGG and GaAlAs laser therapy for treating dentine hypersensitivity: A randomized controlled clinical trial. J Dent 2011;39:249-54.
36. van As G. Erbium lasers in dentistry. Dent Clin North Am 2004;48:1017-59, viii.
37. Rosenstiel SF, Land MF, Crispin BJ. Dental luting agents: A review of the current literature. J Prosthet Dent 1998;80:280-301.

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