

Proximal contact tightness between two different restorative materials – An *in vitro* study

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ABSTRACT

Creating tight anatomic correct proximal contacts still remains difficult when placing direct posterior composite resin restorations. Inadequate contact may lead to food impaction, periodontal diseases, and cause tooth movements. Research has tried to overcome existing problems by improving material characteristics. The aim of the study is to evaluate proximal contact tightness between two different restorative materials using dental floss under foreign direct investment criteria. 40 ivory lower left first molars with standardized MO cavities were randomly divided into two groups ($n = 20$) as follows: Charisma composite (Heraeus Kulzer, Microfill) and Cention N (ivoclar vivadent resin-based filling material). In both the groups, sectional matrix band and the prepared teeth were restored. Procalcitonin was measured using the tooth pressure meter (University of Technology, Delft). The data were analyzed using one-way ANOVA and Tukey *Post hoc* tests ($P < 0.05$). There was no statistically significant difference between Cention N and Charisma composite. Cention N can be used as an alternative in restoring Class II restoration. A well designed randomized controlled study with long-term follow-up must be performed to give valid evidence on the proximal contact tightness.

Keywords: Cention N, charisma, composite, proximal contact tightness

Introduction

An adequate proximal contact is necessary to maintain a well-functioning dentition. When a proximal contact is inadequate, it may lead to food impaction, tooth migration, periodontal complications, and carious lesions.^[1-3] When the contact is too tight, it may lead to tooth migration or trauma of the periodontal tissues.^[4,5]

Hence, research had made an effort to overcome these problems by improving material characteristics and application techniques. The choice of the matrix system, separation technique and restorative material is an important factor. At present, traditional Tofflemire matrix systems are used popularly but fail to create tight proximal contacts.^[6]

In several *in vitro* and *in vivo* studies, sectional matrix systems in combination with separation rings showed tight proximal contacts in two surface Class II cavities.^[7-10]

With amalgam, a tight proximal contact can be obtained by condensing the material. The assumption that applying pressure on the composite resin material would have the same effect was one of the main reasons to develop high viscous composites or ceromers.^[11]

Cention N, the alkasite restorative, is an esthetic, strong, user-friendly, ion, and fluoride releasing, dual curing resin basic filling material.

The aim of the study is to evaluate proximal contact tightness between two different restorative materials using dental floss under foreign direct investment (FDI) criteria.

Materials and Methods

Forty Nissan plastic typodont posterior teeth [Figure 1] were used in this study. The typodont teeth duplicate the morphology of natural teeth and are made of plastic materials such as ivory, melamine, and polycarbonate, and so they have consistency and strength of the real tooth. The teeth manufactured by Nissan co., Nakagoku, Kyoto, Japan.

In all the 40 posterior Nissan teeth, mesio-occlusal cavity preparation was done with diamond burs in a high-speed handpiece [Figure 1]. The teeth were equally divided into two groups. Group 1 - Charisma composite (Heraeus Kulzer, Microfill) [Figure 2]. Group 2 - Cention N (ivoclar vivadent resin-based filling material) [Figure 3].

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Sectional Triodent matrix band (V3 system, Ultradent product.inc) is used to get proper proximal contact and contours [Figure 4].

In Group 1, the adhesive (Gluma 2 bond Heraeus Kulzer) was applied according to the manufacturer's instructions and polymerized with a halogen polymerization unit for 10 s (QHL75 lite, Dentsply, York, PA, USA, light intensity 450 mW/cm²). Following which resin composite (Charisma smart, Heraeus Kulzer microhybrid) was then applied in three increments: A horizontal gingival, an oblique buccal, and an oblique lingual increment. Each layer was separately cured for 20 s from the occlusal direction [Figure 5].

In Group 2, Cention (ivoclar vivadent resin-based filling material) powder and liquid were mixed according to the manufacturer's instructions. Before setting, the material was condensed and carved using Teflon coated instrument and cured for 20 s in occlusal direction [Figure 6].

All the restorations were placed by one operator. Two examiners evaluated proximal contact tightness using dental floss [Figure 7] under FDI criteria [Table 1].

Data analysis

Chi-square test was applied to assess the association between the categorical variables and outcome. A $P=0.05$ and less was considered to be statistically significant [Tables 2 and 3]. Kappa statistical test is used for interexaminer consistency.



Figure 3: Cention N resin-based material



Figure 1: (a) Forty Nissan Typodont posterior teeth (b) MO conventional cavity is prepared in all posterior teeth



Figure 4: Triodent V3 sectional matrix system



Figure 2: Charisma microfill composite



Figure 5: MO cavities restored with charisma composite



Figure 6: MO cavities restored with Centon N



Figure 7: Proximal contact tightness evaluation using unifloss

Results

There was no statistically significant difference between two groups. The scores were statistically analyzed using kappa statistical test for interexaminer consistency, and the result of the analysis was 0.788.

Discussion

The proximal contact tightness was evaluated by passing the dental floss through interdental contact area and the scoring was given using FDI criteria. However, this method is not sensitive enough to record the minor changes. There are devices that can objectively determine the proximal contact tightness. The first instrument was designed by Loomans *et al.*^[8] at University of Technology at Delft, Netherlands. While the second one was developed by investigators at University of Tokushima, Korea.^[12] This instrument measure proximal contact tightness in unit of force, that is, Newton. As these methods were not commercially available, we were forced to access the outcome using traditional method.

Class II posterior composite resin restorations placed with a combination of sectional matrices and separation ring resulted in a stronger proximal contact than when a circumferential matrix system was used - Loomans *et al.*^[13]

Table 1: FDI World Dental Federation: Clinical criteria for the evaluation of direct and indirect restorations

Score	Proximal contact tightness	Functional properties
1	Normal contact point (floss or 25 µm metal blade can pass)	Clinically excellent
2	Contact slightly too strong but no disadvantage (floss or 25 µm metal blade can only pass with pressure)	Clinically good
3	Somewhat weak contact, no indication of damage to tooth, gingiva or periodontal structures; 50 µm metal blade can pass	Clinically sufficient/satisfactory
4	Too weak and possible damage due to food impaction 100 µm metal blade can pass	Clinically unsatisfactory
5	Too weak and/or clear damage due to food impaction and/or pain/gingivitis	Clinically poor

FDI: Foreign direct investment

Table 2: Scorings given by examiner 1

Examiner 1: Centon N and Charisma composite					
Groups	Proximal contact tightness FDI criteria				Total
	1.0	2.0	3.0	4.0	
Charisma	11	9	0	0	20
Centon N	9	7	2	2	20
Total	20	16	2	2	40

Chi-square test: 0.217. FDI: Foreign direct investment

Table 3: Scorings given by examiner 2

Examiner 2: Centon N and Charisma composite					
Groups	Proximal contact tightness FDI Criteria				Total
	1.0	2.0	3.0	4.0	
Charisma	10	10	0	0	20
Centon N	8	8	3	1	20
Total	18	18	3	1	40

Chi-square test: 0.217. FDI: Foreign direct investment

With increase in demand of dentist using composites in selected posterior load-bearing situations, a proportion of practitioners still do not prefer to place composite at all in the Class II preparations. The use of separation ring is not advisable in restoring amalgam restoration because it may lead to aggressive tooth movement and restoration fracture while removing the separation ring and matrix assembly. Hence, the use of such separation rings should be reserved for composites restorations only.^[14]

Another controversy with Class II composites is proximal wear. The contact strength of proximal restoration is unstable. In fact, it is supposed to change overtime on account of mesial movement and proximal wear.^[13] It is not known whether the proximal wear occurs differentially on contacts built with different operative techniques. However, Demarco *et al.* showed that proximal contacts built with composites showed poor performance on 2 and 4 years follow-up.^[15,16]

The Centon N resin-based filling material is easy to do clinically and does not require any special products or learning additional skills. As there is demand in tooth colored restorations, this material of choice can be a cost-effective way to deliver a high-quality, predictable restoration, and less time.

Conclusion

There was no statistically significant difference between Cention N and Charisma composite. Cention N can be used as an alternative in restoring Class II restoration. A well designed randomized controlled study with long-term follow-up must be performed to give valid evidence on the proximal contact tightness.

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