Incidence of tooth sensitivity after resin composite class III restoration with flowable composite as liner

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ABSTRACT

Resin composites is one of the currently most frequently used aesthetic restoration material. A drawback of resin composites is contraction of polimerization which may result in the coming about of dental sensitivity due to microleakage. Flowable composite has high flow capacity and better adaptation capability making the thinnest application on cavity surfaces. An advantage of flowable composite is the possibility of using it as liner in composite resin restoration, which is expected to minimize the occurrence of post restoration dental sensitivity. This research was a descriptive research using the purposive sampling technique. The sample consisted of 27 first incisive and/or second incisive permanent maxilla teeth. A sensitivity test was used on the sample using chlor ethyl and completing questionnaire by patients. The result of dental sensitivity test indicated that 88.9% of the patients did not experience post restoration dental sensitivity and 11.1% of the patients was experience a decrease of dental sensitivity level. Based on research results the conclusion could be drawn that the used of flowable composite as a liner in resin composite class III restoration didn't had a post restoration dental sensitivity.

Key words: Flowable composite, liner, sensitivity

INTRODUCTION

Tooth is a hard tissue in human body comprises of enamel, dentin, cementum, and pulp. Enamel composes of 92% mineral, 8% organic substance and water. Enamel is the hardest tissue of tooth with no regeneration capability, so when it is damaged it does not go on self-repair. Further damage of tooth can be prevented by restoring the missing part or parts undergoing breakage with restoration materals.[1]

Based on its color, restoration material can be divided into aesthetic restoration material and non-aesthetic restoration material. Aesthetic restoration material includes resin composite, glass ionomer, silicate cement and porcelain. Whereas non-aesthetic material includes amalgam and cast metal. The entire tooth restoration procedures can generate stimulus to pulp including during preparation, etch/bonding application, material polymerization process, or finishing.

Resin composite is first acknowledged in dentistry in the mid of 1960, and it is a restoration substance with tooth-like color, having good physical and mechanical characteristics and has the ability to meet aesthetic requirements. These make resin composite the most used restoration material today.[2] Resin composite has several advantages, i.e. except its color meets aesthetic requirements, it is restorable and bound to dental

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structure so it has good retention and able to strengthen the remaining structures.[3] Other advantages include its property as a non-heat conductor and the fact that it does not generate galvanic current as in metal restorations.[4] The main disadvantage of resin composite is the shrinkage during polymerization. This shrinkage will result in gap formation that can reduce border density so bacteria and liquids can enter dentinal tubules and generate sensitiveness after restoration. The shrinkage may also cause secondary caries.[5] Shrinkage during polymerization cannot be eliminated, but can be minimized only by using proper techniques.[3]

The use of liner and the application of resin composite in layers is one of the way to minimize shrinkage during polymerization. Flowable composite is a liner material with lower viscosity compared to packable composite and has good wetting ability[6], so with its high flow capacity, flowable composite can produce fairly thin layers that are well adapted to all cavity areas.[7]

Tooth sensitivity is a condition of increasing tooth sensitiveness towards stimuli from outside as a result from dentinal tubule opening and it is described as a brief sharp pain. The pain will disappear when the stimulus stops. It is clinically described as over response to non-noxious stimuli and shows symptoms than can be classified as true pain syndrome.[8] As a general condition, tooth sensitivity is a temporary tooth pain related to a variety of exogenous stimuli such as thermal, tactile, osmotic, and chemical stimuli.

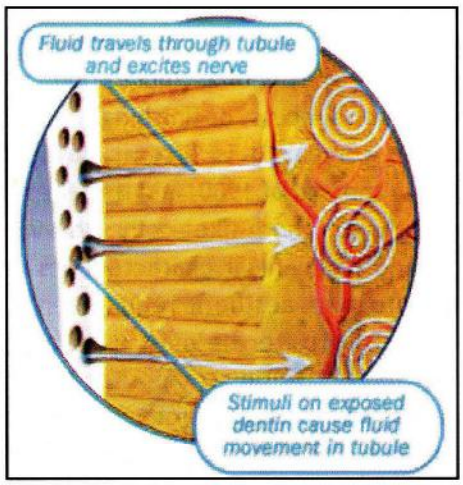

Figure 1. Illustration of hydrodynamic theory.[9]

There are several theories explaining the incidence of tooth sensitivity including dentin innervation theory, odontoblast as receptor theory, odontoblast movement theory, and hydrodynamic theory. Hydrodynamic theory is based on an assumption that liquids movement inside dentin tubuli disrupts pulp environment and this movement is sensed by nerve endings in the area. Liquids movement in dentin tubuli interrupts the balance of hydrostatic pressure inside pulp chamber. This pressure alteration activates nerve endings around odontoblast and generates impuls.[9-13]

Tooth sensitivity is resulted from dentinal tubule opening. During cavity preparation, dentinal tubule endings crossing the entire dentin parts are cut so bacteria and liquids can enter the tubules and cause tooth sensitivity and pulp inflammation. After cavity preparation, enamel on cavity border is acid-etched, forming micro-porosity to produce bonding between enamel-resin surfaces. Acid etch exposure on dentin results in demineralization of dentinal tubule wall, causing dentinal tubule enlargement. Bonding substance forms resin tags on enamel with microporosity, causing mechanical interlocking bonding.

Shrinkage during polymerization of resin composite results in the breaking of adhesive force between resin composite and cavity wall, forming gaps that allow bacteria and liquids to enter the dentinal tubule as well as causing sensitiveness after restoration. Since dentinal tubule contains mechanoreceptor nerves that end at the pulp, small movement of liquids inside the tubule caused preparation, pressure difference, or temperature change can cause sensitiveness.[3]

Based on the comparison of resin matrix volume and filler material, resin composite can be categorized as nonflowable composite and flowable composite: Packable composite (nonflowable composite) is a high content of filler material will influence flow capacity of resin composite, so the higher the content of filler material the higher its viscosity. The increase content of filler material will increase elasticity modulus, reducing shrinkage and stress. Flowable composite has filler material content of 20-25% lower than in nonflowable composite to produce low viscosity[14], high flow capacity, better adaptability to cavity

wall, easier placement, as well as better elasticity compared to the previous composite types.[15,16] Higher flow capacity of flowable composite facilitates flowable composite application to the cavity so it can be applied as thin as possible.[15] This application allows polymerization to take place completely so any micro leakage can be prevented. The use of flowable composite as liner has several advantages, including its function as shock absorber, and its ability to reduce shrinkage resulted from polymerization.[3] In addition, flowable composite has good wetting ability.[6]

Flowable composite has two characteristics necessary for application that are absent in other resin composite types, i.e. not sticky property and can be applied using syringe leading to easy flow and even distribution of the material on the cavity base.[7,17] This allows the flowable composite to adapt well on the cavity surface[16] and capable of sealing and covering micro-structural coarseness on cavity surface so gaps formation between cavity surface and resin composite can be reduced.[6] Flowable composite with low elasticity modulus and high flexibility is believed to reduce tension resulted from contraction during polymerization and produces better bonding with tooth structure, as well as results in stronger restoration margins.[18,19]

Flowable composite has low compressive strength and tensile strength so it cannot be used as a restoration material on a cavity with a great deal of pressures and frictions.[6,7,15] Based on low viscosity, high flow capacity, wetting ability, good adaptability, and easy to apply, flowable composite is indicated as liner on resin composite restoration as an effective way in reducing or coping with gaps between restoration material and cavity surface resulted from contraction during polymerization.[18,20]

Based on those reason, we interested to find out an incidence of tooth sensitivity after resin composite class III restoration with flowable composite as a liner.

MATERIALS AND METHODS

This research was a descriptive research using the purposive sampling technique. This study was carried out on 21 patients with media caries on proximal mesial/distal central incisor 1 and or lateral incisor 2, with total 27 teeth indicated for resin composite class III cavity restoration. All of tooth samples were restored with resin composite and flowable composite as liner. Before restoration, patients were required to fill out questionnaire sheets and teeth for studied were subjected to a cold test using chlorine ethyl. Three days after restoration, patients filled out another questionnaire sheets and restored teeth which were being studied were cold tested with chlorine ethyl.

RESULTS

The results of this research, presented in Table 1-4.

Table 1. The comparison of patients' responses to sensitive or uncomfortable sense complaint on anterior teeth experienced before and after restoration.

Response	Before		After	
	N	%	N	%
Yes	16	59.3	2	7.4
No	11	40.7	25	92.6
Total	27	100	27	100

Table 2. The comparison of patients' responses to sensitive and uncomfortable senses experienced before and after restoration.

Response	Before		After	
	N	%	N	%
No pain	11	40.8	25	92.6
Less pain	1	3.7	2	7.4
Pain	8	29.6	0	0
Very pain	7	25.9	0	0
Total	27	100	100	100

Table 3. The comparison of patients' sensitivity sensed before and after restoration.

Before / After	No pain	Less pain	Pain	Very pain
No pain	11	0	0	0
Less pain	1	0	0	0
Pain	7	1	0	0
Very pain	6	1	0	0

DISCUSSION

Resin composite underwent shrinkage when setting, and this is called polymerization

shrinkage. This phenomenon cannot be eliminated. Therefore there are several applications procedure techniques need to be done in order to help reducing the potential of shrinkage. The first technique is that resin composite contacts as minimum as possible with cavity wall during polymerization process. The second technique is a quantity control and methods in applying resin composite into the cavity. Application technique layer after layer will result in lower tension compared to one bulk technique.[21] The third technique is the application of etch material and bonding agents on the cavity surface in order to reduce this shrinkage problem.[3]

The use of flowable composite as liner will minimize contraction during polymerization so sensitivity after resin composite restoration can be prevented. As seen on Table 1, the percentage of tooth sensitivity after restoration decreased compared with prior to restoration. After restoration there were still 7.4% incidences with tooth sensitivity. Based on Table 2 and 3, there was change in sensitivity degree. Of 2 teeth which still experienced sensitivity after restoration, sensitivity on both teeth was decreasing from pain (3) and very pain (4) to less pain (2). Enduring sensitivity after restoration can be caused by too deep of cavity, or the existence of etch acid residue, as well as micro-leakage/nano-leakage.

Table 4. Patients' responses to cold test with chlor ethyl before and after restoration.

Cold test			Cold test		
N	Before	After	N	Before	After
1	4	2	15	3	1
2	4	1	16	3	1
3	3	1	17	2	1
4	3	2	18	2	1
5	2	1	19	2	1
6	3	1	20	4	1
7	3	1	21	3	1
8	3	1	22	4	1
9	3	1	23	3	1
10	3	2	24	3	1
11	2	1	25	3	1
12	3	1	26	2	1
13	3	1	27	2	1
14	2	1			

Nano leakage occurred as a consequence of etch acid procedure.[22]

Table 4 showed tooth sensitivity test using chlorine ethyl after restoration. On three teeth, showed reducing sensitivity level from very pain (4) and pain (3) to less pain, whereas the rest of 24 teeth experienced no pain (1). This means that the use of flowable composite as liner can minimize polymerization contraction so post-restoration tooth sensitivity can be prevented. This corresponds to an experiment conducted by Attar et al.[15] and Tung et al.[23] that the application of flowable composite can reduce marginal leakages. Experiments conducted by Alonso et al.[21] and Leevailoj in Moon et al.[24] also showed that flowable composite applicaton as liner reduced microleakages. To prevent tooth sensitivity after restoration, on the cavity with high coherence disturbance potential, tension from the inside can be reduced by slow "soft start" polymerization instead of high intensity radiation, layer after layer application to reduce contraction during polymerization, and stress-breaking liner application.

CONCLUSION

Based on the research, it was concluded that flowable composite as a liner with low viscosity will play a part as a stress-absorber layer since its low elasticity modulus increases marginal seal by adding dentin and resin adhesive power. Liner with low elasticity modulus will function as a shock-absorber or shock-breaker. Flowable composite as a liner can decrease the percentage of tooth sensitivity after restoration.

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