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Effect of soft start and pulse LED curing modes on postoperative sensitivity after composite restoration of cervical abrasion - A randomised control clinical trial

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ABSTRACT

Aim

To assess the impact of soft start and pulse LED curing techniques on postoperative sensitivity following composite restoration of cervical abrasion

Material and method

All the patients were chosen based on the inclusion requirements and split into two groups. 20 people were chosen as the sample size for each group. The lesion was made ready by acid etching, bonding agent application, and curing. The incremental approach was used to place the composite restorations, and each increment was appropriately cured in either group A's soft start mode or group B's pulse mode. After one week and one month, the patients were called back to evaluate the postoperative sensitivity.

Result

The difference between pulse led cure mode and gentle start had no statistically significant impact on postoperative sensitivity.

Conclusion

When compared to pulse curing approach, restorations cured using the gentle start curing technique did not exhibit any appreciable alterations in postoperative sensitivity.

Keywords: *Postoperative sensitivity, Soft start curing, Pulse LED curing, Composite restorations, Cervical abrasion.*

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INTRODUCTION

The most popular adhesive tooth-colored restorative material in dentistry is composite resin because of its aesthetically pleasing look and long clinical service life. Additionally, they have certain downsides such as secondary caries, microleakage, postoperative sensitivity, and marginal discoloration. High clinical expertise and in-depth subject knowledge are needed to minimise these downsides. Following composite repair, one of the main clinical complaints from patients is postoperative sensitivity. Most composite restorations—about 30%—have it.[1,2] The polymerization shrinkage that takes place at the composite-tooth interface is what causes postoperative sensitivity, which is merely a clinical expression of this process. The debonding of the restoration, the development of enamel cracks, and microleakage are some additional effects of polymerization shrinkage.

Polymerization shrinkage is the volumetric contraction that occurs when free-flowing molecules known as monomers are transformed into cross-linked polymers, which are stiff assemblies. Within 24 hours of curing, there is shrinkage between 1.5 and 4 percent by volume.[3] This polymerization shrinkage creates strains at the restoration's boundary; when these tensions are too great, a microgap forms, which makes the repair sensitive to fluid movement.[4]

A few elements affecting shrinkage during polymerization include:

1. Filler content: More fillers lead to less shrinkage because they don't contribute to the polymerization reaction.
2. Conversion degree: The shrinkage of polymers is inversely correlated with the degree of conversion.
3. Water sorption: The polymerization contraction is offset by hygroscopic expansion.
4. C Factor: A lower C factor means that less of the material's surface will come into touch with it, reducing shrinkage.[5]

Shrinkage caused by polymerization harms both the tooth and the repair. Though it cannot be totally removed, it can be diminished by either changing the resin's composition or the therapeutic procedure.

Three components make up a composite: a resin matrix, filler, and coupling agent. Less shrinkage is produced by high molecular weight resins like BisGMA and TEGDMA and larger filler contents.[3] Clinical procedures including progressive stacking and gradual curing modes have decreased polymerization shrinkage.[6] The C factor is reduced, the restricted depth cure is overcome, and the residual stress concentration is reduced by using incremental layering procedures and changing the cavity design. By extending the resin matrix's pre-gel phase, slow curing modes relieve the strains.

Two slow curing modes—soft start and pulse modes—are claimed to reduce polymerization shrinkage.[7] The purpose of this study was to assess the soft start and pulse LED curing modes' postoperative sensitivity following composite repair of a cervical abrasion lesion.

MATERIALS AND METHODS

Sample size

Using the G power sample size calculator, the sample size was determined to be 20 for each group.

Inclusion criteria

- Patients between 30 and 60 years old.
- Cervical lesions that are asymptomatic, and less than 3 mm deep.

Exclusion criteria

- Patients with preoperative sensitivity or gingival recession.
- Patients using any desensitizing medication.

Patients who met the inclusion criteria were enrolled in the study after Saveetha Dental College received approval from the University Scientific Review Board. The study procedure was explained to the patient before receiving their informed consent.

Asymptomatic, non-cancerous cervical abrasion lesions with a maximum depth of 3 mm were chosen. Gingival retraction cords were used to perform the isolation. The lesions were created by 20 seconds of acid etching. Application of the bonding agent was followed by a 30-second curing period in continual mode. The composite was applied using a technique called progressive layering, with each increment not exceeding 2 mm.

There was randomization and allocation concealment. All patients were split into two groups: Group A was placed in the soft start mode, while Group B was placed in the pulse mode.

After one week and one month, patients were recalled to evaluate the postoperative sensitivity. Using a cool air stimulus and probing, clinical sensitivity was evaluated.

Numeric Rating Scale was used to capture the response. [NRS]
0 - No sensitivity at all
1- 3 sensitivity to light
4-6 reasonable sensitivity
7-10 extreme receptivity

Static evaluation

Paired t tests were used to compare the same groups throughout time intervals, and independent t tests were used to compare the intensity of postoperative sensitivity across groups 1 and 2 over time intervals of immediately, one week, and one month.

The significance threshold was set at 0.05.

RESULTS

Table 1 – Group I vs II immediately after restoration

GROUPS	MEAN	STANDARD DEVIATION	p VALUE
I	0.2000	0.42164	0.556
II	0.1000	0.31623	0.557

Table 2 - Groups I vs II after 1 week

GROUPS	MEAN	STANDARD DEVIATION	p VALUE
I	2.1000	0.99443	0.179
II	2.8000	1.2297	0.179

There was no statistically significant difference between the two groups right after restoration and one week later, according to an independent t test with a p value of >0.05.

DISCUSSION

Stresses can be created at the interface due to polymerization shrinkage, which is a characteristic of resin composites. Adhesive failure, microgaps, and microleakage are caused when this stress surpasses the bond strength, and clinically, sensitivity is the result. Allowing the resin composite to flow while it sets up via controlled polymerization is one method of reducing polymerization shrinkage. A low power density pre-polymerization followed by a high power density final cure can accomplish this.[8] It has been asserted that slower polymerization results in improved molecular flow in the material, lowering the stress caused by polymerization shrinkage in a restoration, which is connected to less shrinkage. When adopting slow curing modes, such as soft start and pulse mode, sequential polymerization occurs. The rate of monomer to polymer conversion is delayed extending the pre-gel stage, hence minimizing the stress buildup produced by polymerization shrinkage.

Chan et al. evaluated the soft-start polymerization technique in Class I and II composite restorations and concluded that it did not significantly alter postoperative sensitivity or reduce signs of marginal stress. There are numerous studies testing the postoperative sensitivity with alternating curing regimens.[9] Senthil Kumar et al. also came to a similar conclusion after evaluating microleakage in both constant and soft start healing modes and finding no discernible difference between the two.[10] In contrast to Umer et al's[11] study, which found no statistically significant difference in postoperative sensitivity between soft start and constant curing modes, Alomari et al[12] concluded that pulse curing mode reduced postoperative sensitivity after placing composite restorations in class 2 cavities when compared to fast curing mode. Studies have compared either pulse mode to constant mode or soft start mode to constant mode, but none have compared the effects of the two.[13,14] This study's primary goal was to evaluate how well both slow curing strategies work to minimize polymerization shrinkage.[15]

Because they frequently have margins on both the enamel and dentin surfaces, non-carious cervical abrasion lesions were chosen for this study. This allows for simultaneous evaluation of the lesions' dentin and enamel surfaces, and the study's preparation and restoration techniques are also relatively straightforward, reducing operator variability. Split mouth design was chosen for this study because it allows both groups to be tested on the same subjects, minimizing variability, and boosting the study's power.[16] Similar to the full mouth design, patient recruiting appeared straightforward and required fewer patients, which decreased dropout rates.

According to the study's findings, there was no demonstrably different effect on postoperative sensitivity between pulse led and gentle start treatment types. One rationale is that both pulse and soft start led curing modes generate light with identical intensities, which results in the same amount of composite flow and conversion rates and, thus, the same amount of polymerization shrinkage.[17,18,19]

The postoperative sensitivity did however gradually disappear over time. After one month, no sensitivity was seen in any of the patients, demonstrating that postoperative sensitivity is a time-dependent component and that it improves over time.

CONCLUSION

Within the constraints of this investigation, it can be stated that restorations cured using the soft start curing approach did not significantly differ from pulse curing technique in terms of postoperative sensitivity, showing that both slow curing modes offer comparable polymerization shrinkage. It will take more research to support this finding.

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Conflicts of interest - There are no conflicts of interest.

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