



## Original Article

# Questionnaire Survey about Knowledge of Incremental Techniques in Composite Placement among Dentists in South India

*N.S.Harini, Jayalakshmi<sup>1</sup>, M.Sankari<sup>2</sup>*

*Department of Conservative Dentistry and Endodontics and <sup>1</sup>Periodontics<sup>2</sup>, Saveetha Dental College, Saveetha Institute of Medical and Technical Sciences, Saveetha University, Chennai, Tamil Nadu, India.*

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## Abstract

**Introduction:** Dental composite resins are types of synthetic resins which are used in dentistry as restorative material or adhesives. Synthetic resins evolved as restorative materials since they were insoluble, esthetic, and insensitive to dehydration. Polymerization shrinkage is one of the major disadvantages in composites due to “c” factor. The aim of the study was to reduce this configuration, factor incremental techniques have been used. Several incremental techniques being followed by dentists. Incremental techniques are one of the most comfortable and qualitative technique which reduces “c” factor in composites. This is a questionnaire survey which assesses the most practiced incremental technique by various dentists. **Materials and Methods:** A questionnaire survey about the most popularly used incremental techniques being used in composite placement by several dentists has been analyzed. **Results:** Seventy percent of dentists are practicing incremental techniques in composite placement. The rest 30% of dentists are practicing bulk-fill techniques. Of the dentists practicing incremental techniques, 71.43% are following oblique layering technique, 14.29% are following three-site novel matrix, and the rest 14.29% are following successive cusp buildup technique. **Conclusion:** Of the three incremental techniques, oblique layering technique has many advantages such as allows easier Class II buildup, with proper proximal contact, and proximal smooth surfaces. Another advantage is that there is adequate light exposure for polymerization.

**Keywords:** Composite placement, dentists, incremental techniques, knowledge, oblique layering

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Address for correspondence:

Dr. M. Sankari,  
Department of Periodontics, Saveetha Dental College and Hospitals  
162 Poonamallee High Road, Chennai - 600 077, Tamil Nadu, India.  
E-mail: [dr.sankarim@gmail.com](mailto:dr.sankarim@gmail.com)

## **INTRODUCTION**

We are now living in an era of esthetic dentistry where tooth colored-restorations matching the shade of natural teeth are the most in demand. Since necessity is the mother of invention, evolution of composite resins has seen a cutting edge over other dental restorative materials. Composite resins are widely used in dentistry to restore teeth with structural loss due to their esthetics and physical properties. However, these restoratives have polymerization shrinkage as an inherent problem that may cause residual stresses in the tooth, even when not in function.[1,2] Clinical signs that have been associated with polymerization shrinkage stress include inadequate adaptation at tooth/restoration interface, microcracking, postoperative sensitivity, microleakage, and secondary caries.[3,4] These issues are often responsible for the replacement of composite restorations in posterior teeth.[5,6] Changes in material formulations and filling techniques aimed at reducing volumetric contraction and shrinkage stress, have been the primary approaches for reducing the development

of residual stresses.[7,8] Composite restorations also hold other advantages such as they match the shade of the natural teeth are mercury-free, thermally nonconductive, and bond to the tooth structures with the use of adhesive agents. Placing successful posterior composites is exacting, tedious, and time consuming. The process includes achieving the necessary isolation, selecting, and placing an appropriate matrix, precise execution of the adhesive steps, the placement of a flowable resin, or resin ionomer liner, and finally, the incremental placement, adaptation, and light curing of at least two or more layers of composite. Add to this sculpting, adjusting the occlusion and finishing and polishing and have a procedure, which just takes too much time. This in turn can produce a profitability problem for dentists who have contracted with insurance companies. Given today's overhead per hour, dentists need material and technology advancements so that posterior composites can be placed faster, easier, and profitably without taking compromising shortcuts.[9,10] In recent years, materials have been introduced in an attempt to reduce some of the time and effort needed for layering and adaptation when placing posterior composites.

However, the life of a resin composite restoration is dependent on several factors, including the cavity-composite interface sealing. From this viewpoint, factors related to gap formation mechanism are crucial in improving the clinical longevity of resin composite restorations. Although composite resins possess numerous advantages, one predominant disadvantage is polymerization shrinkage. This shrinkage can lead to failure of the restoration because of the "C" factor or configuration factor. This "C" factor can be minimized by incremental technique. A lot of different incremental techniques have been proposed so far by various authors. Composite resins with high elastic modulus produce more rigid restorations, which increase the effect of polymerization contraction on residual shrinkage stresses.[11]

Filling techniques also influence stress distributions. The potential of incremental composite placement technique to reduce the shrinkage deformation and stress at the adhesive interface is controversial.[12-14] An incremental technique could increase shrinkage stresses due to incremental cuspal deformation by each polymerized increment. The incremental cuspal deformation also leads to a reduction in the volume of the cavity, reducing the amount of composite that is placed in subsequent increments.[14]

## **MATERIALS AND METHODS**

A questionnaire survey containing 10 questions was taken to assess the knowledge about incremental techniques in composite placement among various dentists in South India for which the sample size was 400.

## RESULTS AND DISCUSSION

This study is a survey which is aimed to find out the most common incremental techniques practiced among dentists. The results of the survey are given below [Figure 3]. Seventy percent of dentists are practicing incremental technique in composite placement. The rest 30% of dentists are practicing bulk-fill technique. Among the dentists practicing incremental techniques, 71.43% are practicing oblique layering technique, 14.29% are practicing three-site novel matrix technique, and the rest 14.29% are practicing for successive cusp buildup technique Figure 2.

Resin composite restorations have gained popularity because they match the shade of the natural teeth, are mercury-free and thermally nonconductive, and they bond to the tooth structure with the use of adhesive agents. Direct dental composites can be used for:

- Filling cavity preparations
- Filling gaps which are diastemas between teeth using a shell-like veneer or
- Minor reshaping of teeth
- Partial crowns on single teeth. Although composites are now the material of choice for most restoration, their polymerization shrinkage remains a problem.

### Configuration factor

Resin composite restorations have gained popularity because they match the shade of the natural teeth, are mercury-free and thermally nonconductive,[15] and they bond to the tooth structure with the use of adhesive agents.[16] Although composites are now the material of choice for most restoration, their polymerization shrinkage remains a problem. Modern resin composites undergo volumetric contractions of between 2.6% and 7.1%,[17] resulting in shrinkage stress generation at the composite-tooth interface.[18] These stresses may cause the composite to pull away from the cavity margins, resulting in adhesive failure and marginal gap formation.[19] Oral fluids containing bacteria may fill these gaps, causing microleakage and secondary caries. Other adverse consequences of shrinkage stresses include coronal deformation resulting in postoperative sensitivity, propagation of existing enamel microcracks, and microcracks of composite resin due to cohesive failure.[20]

In 1987, Feilzer *et al.* postulated that the geometric configuration plays an important role in the adaptation of resin composite restoration.[21] The cavity configuration (C-factor) is defined as the ratio of bonded to unbonded surfaces. A high ratio denotes high polymerization stresses, which are accompanied by increased shrinkage stresses. Among many of the factors contributing to the shrinkage stresses, C-factor is an important one. Several techniques have been suggested to improve marginal adaptation of high C-factor preparation, including adhesive systems that potentially resist composite shrinkage[22,23] placement techniques for resin composites,[14,24] protocols for polymerization, and different cavity preparations.[25]

Internal stress can be reduced in a restoration subject to potentially reduce high disruptive contraction forces using:

- “Soft-start” polymerization instead of high-intensity light curing
- Incremental layering to reduce the effects of polymerization shrinkage; and
- A stress-breaking liner, such as filled adhesive, flowable composite, or resin-modified glass ionomers
- The application of non or low-shrinking restorative materials.[24,25]

### The incremental layering technique [Figure 1]

Incremental layering has been advocated for the use in large composite restorations to avoid the limitation of depth of cure, to reduce the effects of polymerization shrinkage, and to enhance the esthetic results from the multilayering of color. Incremental layering with successive layers of dentin and enamel composite creates high

diffusion layers that allow optimal light transmission within the restoration, providing a more realistic depth of color as well as natural surface and optical characteristics. The polychromatic effect is achieved by stratifying variations in shades and opacities of the restorative composite. Polymerization stresses generated by polymerization shrinkage may compromise the bond integrity, leading to concerns such as microleakage, postoperative sensitivity, and ultimately secondary caries. If the composite-tooth bond remains intact, stresses transferred to tooth structure may result in cuspal flexure, enamel fracture, or fractured cusps. Due to the variations in natural teeth, the combinations of different composite shades must be applied in relationship with the anatomy of the tooth, and are specifically adapted to different clinical situations. To minimize microleakage, different incremental insertion techniques have been suggested as a way to improve composite curing in-depth and minimize the effect of confinement on contraction stress development. Instead of using a bulk-fill technique, layering techniques may have some advantages, that is, the use of a small volume of material, a lower cavity configuration factor, and minimal contact with the opposing cavity walls during polymerization.[10,12]

### **Three-site novel matrix techniques**

The technique indicates the use of a metallic matrix band and wood wedges to provide an interproximal contour and contact with the adjacent tooth as well as to provide an adequate cervical adaptation. The first increment of the packable composite resin is applied on the gingival wall of the proximal box, packed cervically near the axial wall, and automatically, the resin climbs up in contact with the inner surface of the matrix band. This increment is sculpted and light cured and the metallic matrix band is removed. Thus, the Class II cavities are transformed into Class I, with free access for light curing. Small incremental layers of composite fill the remaining cavities. This technique is faster than conventional techniques and permits appropriate embrasure, better contour, and contact points.[13-15]

### **Oblique layering technique**

The presence of a high C-factor is a risk for debonding within the resin-dentin interface. For deep Class I cavities, horizontal layering is the most promising way to get a good bond to the cavity floor. Using four horizontal increments, achieved higher bond strengths and to reduce the possibility of cuspal flexure, a composite hybrid with a low volumetric polymerization shrinkage should be used. Opposing enamel walls should not be contacted by the same increment; this will minimize the wall-to-wall shrinkage, and thus reduce intercuspal stress. The application of the composite in oblique layers results in fewer contraction gaps at the margins. It is important to continue to condense and shape the composite resin to correspond to cusp development and replacement of dentin.[25]

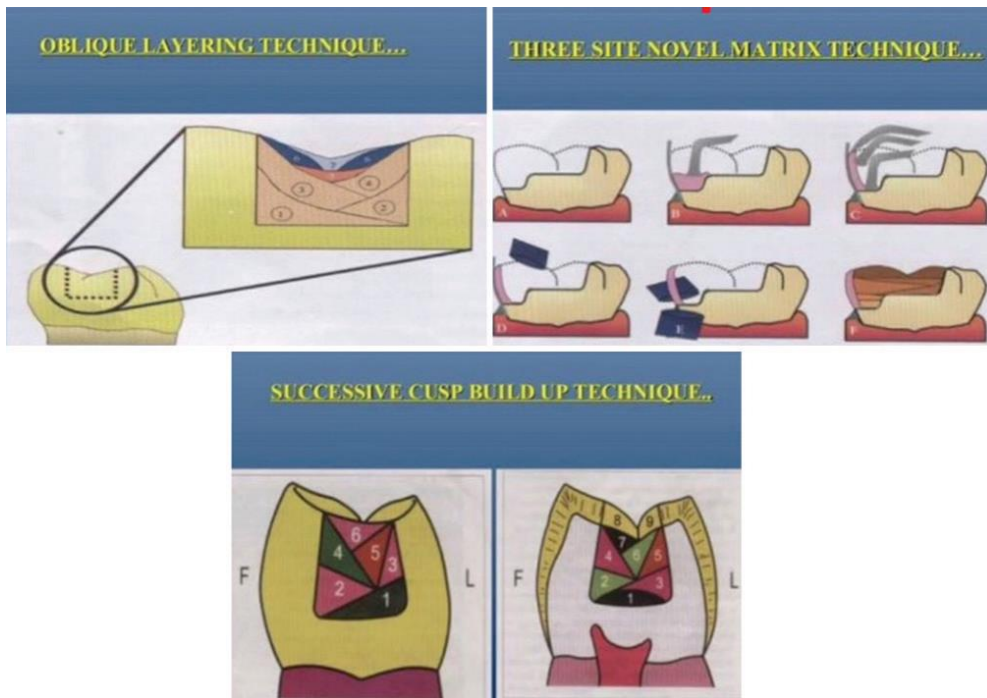
### **Successive Cusp Buildup technique**

Successive cusp buildup is an improved placement technique for posterior direct resin restorations. By placing successive layers of apicoocclusal wedges of composite, the C-factor for each layer is extremely reduced.

This technique gives up a glossy finish and is esthetically much better than any other restoration. In this study, 70% of the dentists are practicing incremental technique in composite placement. The rest 30% of dentists are practicing bulk-fill technique. Among the dentists practicing incremental techniques, 71.43% are practicing oblique layering technique, 14.29% are practicing three-site novel matrix technique, and the rest 14.29% are practicing successive cusp buildup technique.[26] Thus, oblique layering technique is the most practiced incremental technique by various dentists in South India.

### **Reasons to prefer oblique layering technique**

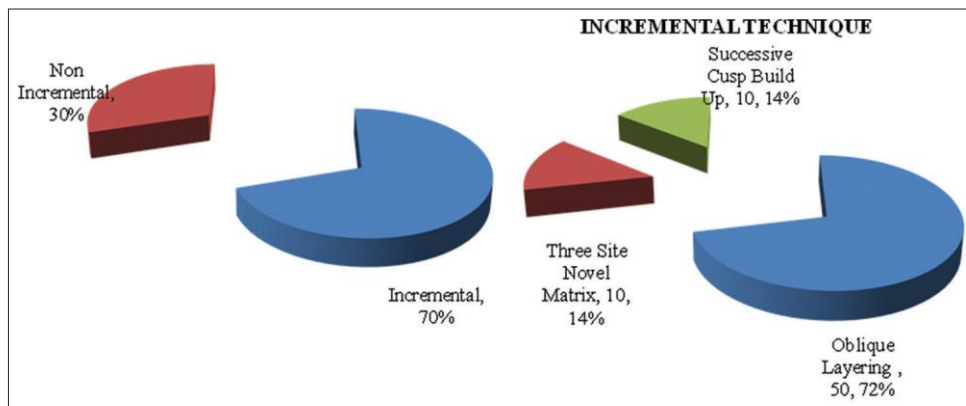
Reduce “c” factor, high strength, withstand maximum masticatory stress, rapid and esthetic, allows easier Class II buildup, with proper proximal contact and proximal smooth surfaces. Another advantage is that there is adequate light exposure for polymerization.[26]



**Figure 1 : Diagram showing various incremental techniques in composite placement**

**Figure 2: Questionnaire**

Questions	Options
1. Years of experience in dentistry?	10 years/15 years/>15 years
2. Have you been trained in composite placement?	Yes/no
3. Do you prefer incremental technique or bulk placement technique?	Incremental/bulk
4. Which incremental technique do you prefer in composite placement? technique/successive cusp build up	Three site novels matrix/oblique layering
5. Factors influencing to follow that technique?	-
6. Disadvantages of that technique?	Yes/no
7. Overall grade for that technique?	Poor/good/excellent
8. Posttreatment problems?	Present/absent
9. Do you use any flowable composites under packable composite?	Yes/no
10. Is the patient satisfied with your composite placement?	Poor/good/excellent



**Figure 3 :** Pie chart showing various techniques used in composite placement among dentists

## CONCLUSION

Composite restorations have revolutionized restorative dentistry due to their conservative nature, adhesive bonding, and patient appeal. The adhesive bonding, ability makes it unnecessary to remove tooth structure for retention, prevention, and convenience. Successful restorations can be done with less precise preparations.<sup>[27]</sup> There is mercury present in the silver-filling material, called amalgam, in the past century there has been no evidence showing that silver fillings are harmful to patients. However, nowadays dentists do not use amalgam filling because of its various disadvantages such as it can corrode over time, amalgam filling does not bond (hold together) with your tooth, etc. Composite fillings are primarily a resin which has been “filled” with other inorganic materials. This compound makes a composite filling more resistant to wear, color adjustable, and easier to polish.<sup>[28]</sup> Composite resin serves as esthetic alternative to amalgam and cast restorations.<sup>[29]</sup>

The marginal integrity of composite restoration refers to its marginal fit and marginal adaptation thereby increasing the longevity of the restorative material.<sup>[30]</sup> Resin composites have been the pinnacle of direct esthetic restorations ever since its discovery.<sup>[31]</sup> It is justifiable to speak of future dental practice because it takes many years for nascent technology emerging from scientific research laboratories to be developed and made commercially available for dentists’ use. Therefore, some of the current research successes represent future improvements in patient care. The durability, reparability, and quality of the surface texture of composites are matters that are receiving considerable research. Anything which improves the strength and durability of this interaction could lead to restorations that are stronger and more durable. Future improvements in the level of oral hygiene, the use of fluorides, antiseptics, sealants, and protective coatings to prevent decay, together with improvements in composites to repair traumatically damaged or malformed teeth, can lead to better general health because of better oral health.

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### Conflicts of interest

There are no conflicts of interest.

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