Bioesthetic Restoration on Endodontically Treated Tooth with Subgingival Extension: An Exploration of the Gellar Model

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ABSTRACT

This case report highlights laboratory technique for fabricating prostheses in endodontically treated teeth with subgingival defects. The Gellar Model, a modified die system, is designed to create physiological and harmonious tooth contours, which can significantly improve periodontal health. This technique allows for better emergence profiles, contacts, and contours in the final prosthesis. While the fabrication process is both effective and efficient, it is challenging in terms of technical complexity and practicality, as it requires long working hours and high precision. However, with the growth of the digital market in dentistry, the scope of CAD/CAM technology is expanding, promising to alleviate the labor-intensive aspects of traditional methods.

Key words: Gellar model, Die system, Subgingival defect, Bio-esthetic restoration

INTRODUCTION

In most cases, teeth requiring endodontic treatment are inherently weak because of significant loss of tooth structure. Additionally, endodontic procedures themselves can cause chemical and mechanical degradation to the tooth. Ultimately, these factors make the tooth fragile, susceptible to secondary caries, and prone to fracture, necessitating suitable coronal restorations that meet both aesthetic and functional demands.[1-3]

Conflict of Interest: None

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The extension of defects in teeth treated endodontically often reaches the subgingival level. Restoring non-vital subgingival tooth defects poses significant challenges and typically requires a multidisciplinary approach.[4] Various approaches for coronal restoration of subgingival extensions in endodontically treated teeth have been proposed in the literature. These range from traditional full-coverage restorations with subgingival margins to recent advances in adhesive dentistry using minimally invasive biomimetic techniques that relocate subgingival defects to supragingival levels.

It has been suggested that restoring with supragingival margins provides greater benefits and ensures a better long-term prognosis compared to placing restorative margins subgingival.[5] Several studies have demonstrated that subgingival restorations are associated with

increased risks of gingival bleeding, attachment loss, and gingival recession compared to supragingival restorations. To mitigate these risks, it is recommended to position the restorative margin approximately 3-4 mm coronal to the alveolar crest.[6] Techniques such as crown lengthening, orthodontic extrusion, or deep margin elevation are recommended to achieve restoration at the supragingival level.

The choice between direct and indirect restorations for endodontically teeth is often debated. Creating a bio-esthetic restoration in full coverage restoration involves ensuring proper margin adaptation, building correct contacts and contours, and enhancing the emergence profile to maintain periodontal health. Achieving bio-esthetic restoration in subgingival defects is challenging yet mandatory. This process is complex and requires more than just obtaining a good impression; it also necessitates effective collaboration between the dentist and the lab technician.

Research shows that crowns have a significantly longer survival rate than direct restorations. [1-3] While direct restorations can offer a predictable outcome, they often suffer from the loss of tooth structure and the effects of endodontic treatment, leading to a questionable long-term prognosis. Common issues include color mismatch over time, potential for microleakage, secondary caries due to resin polymerization shrinkage, and loss of retention. In contrast, lab-fabricated full coverage prostheses provide superior emergence profiles, proper contacts, and overall stability.[7]

Maintaining a subgingival margin always presents a risk to periodontal health. However, this risk can be mitigated by fabricating the prosthesis using a bio-esthetic approach. Various die systems are discussed in the literature, including working casts with separate dies and those with removable dies. A high-quality working cast or die is essential for capturing all the details of the prepared tooth, adjacent teeth, and surrounding soft tissue.[8-10] This detailed working cast or die is crucial for fabricating a well-fitted prosthesis and serves as a vital link between the dentist and the lab technician. Another dependable method for achieving a precise and esthetic restoration is the Gellar model. This model can simplify the dentist's work, ensure proper die orientation within the dental model, enhance fabrication accuracy, and result in a better-fitting restoration.

This case report discusses a bio-esthetic approach using a Gellar model to fabricate an indirect restoration for an endodontic treated tooth with a subgingival margin.

CASE REPORT

A 23-year-old patient presented to the Department of Prosthodontics, People's Dental College and Hospital for the placement of crown after an endodontic treatment of the upper left back tooth. The root canal treatment was completed 1 month back and restored with direct composite on the distal half of the crown of #24. (Figure 1) During the first appointment, clinical and radiographic examinations were done and pre-operative photographs were taken. The tooth was clinically asymptomatic. On smiling, the premolars were visible, hence were present in the esthetic zone. However, on radiographic evaluation, an overhanging restoration was present on the distal aspect. Furthermore, the main concern of the patient was the durability of the restoration and was esthetically concerned.

Thus, it was decided to remove the restoration to assess its extent. Upon removal, it was found that the healthy tooth structure was below the gingival margin on the distal half. Additionally, soft caries was detected and subsequently removed using a small round bur. Different treatment options for this case was given to the patient and was made aware of all the possible

consequences for each treatment modality. The patient chose to go with indirect restoration approach.

Tooth preparation was carried out for an all-ceramic veneered zirconia crown. A uniform 2 mm reduction was done on the axial and occlusal surfaces, with the decision to place the margin subgingivally on the distal aspect, and supragingivally on the buccal, palatal, and mesial aspects. (Figure 2)

Following the initial tooth preparation, an alginate impression was taken of both the maxillary and mandibular arches. A provisional restoration was then fabricated using the indirect technique and temporarily cemented onto the prepared tooth. (Figure 3) The patient was recalled after a week, and upon removal of the provisional and cleaning of the area, gingival overgrowth was observed on the distal margin. (Figure 4)

The gingival overgrowth was removed using a bur. Hemostasis was achieved with a hemostatic agent containing aluminum chloride. With proper field isolation, gingival retraction cord 000 was used to retract the gingiva, allowing for the final tooth preparation. After leaving the cord in place for 10 minutes, it was removed. (Figure 5)

The final impression of the prepared tooth was taken after 2 weeks using putty and light body following the two-step impression technique. (Figure 6) After an hour, the section of impression involving prepared tooth and one adjacent tooth on either side was poured with type IV gypsum material. Stone was built up to a height of approximately 1.0 inch over the preparation. (Figure 7 A, 7B)

The cast was carefully removed from the impression. This initial cast was then modified to create the Geller model.

To create the Geller model, the cast was trimmed on a model trimmer to remove any excess stone around the prepared tooth. The handle of the die was made slightly larger in diameter than the preparation, with its sides parallel or slightly tapered toward the base. The handle was aligned parallel to the long axis of the tooth.

Using a pear-shaped acrylic bur, the die ditching was done to enhance the margin on the die. The die must be conical in shape and very smooth, without any undercuts. (Figure 8) Anti-rotation grooves were created on two proximal surfaces of the apical portion using a straight bur. (Figure 9) Subsequently, the die was dipped in low-fusing temperature wax limiting only up-to the conical area, avoiding the cervical margin or the area above it, process known as glazing the cone. (Figure 10)

Carefully, the die was reassembled back into the impression at the exact position of the prepared tooth. After ensuring its proper alignment and stablility, it was sealed on the impression using wax. (Figure 11)

Then another mixture of Type IV Gypsum was poured impression and allowed to set, creating our working cast with a removable die. (Figure 12)

Once the stone had set, the die was gently removed from the impression. (Figure 13 A, 13B) Pulling the die from the working cast is an intricate process. If the above-mentioned steps were done accurately, it will be easier to remove the model from the cast.

Verification of right fit of the die to the working cast was done then this model was sent to the laboratory for the fabrication of the definitive prosthesis, a layered zirconia crown. (Figure 14,15)

Figure 1: *Pre-operative Photograph*

Figure 2: *Tooth Preparation on #24*

Figure 3: *Provisional restoration on #24*

Figure 4: *Gingival overgrowth on distal aspect of #24*

Figure 5: *Gingittage done and Hemostasis achieved with 000 retraction cord on #24*

Figure 6: *Definitive Impression using putty and light body elastomer*

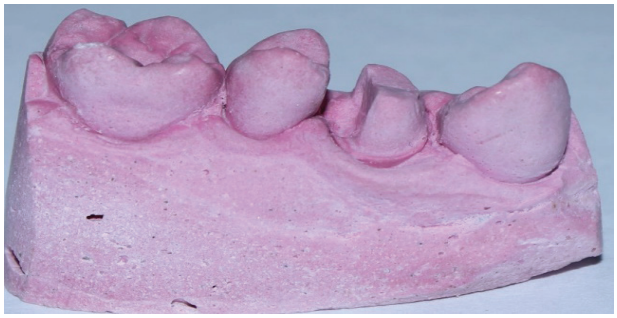

Figure 7 A,B: *Sectional cast for Removable die made of Type IV gypsum*

Figure 8: *Conical shape of Removable die*

Figure 9: *Anti-rotational groove*

Figure 10: *Glazing the cone*

Figure 11: *Carefully placing the die in the definitive impression*

Figure 12: *Impression poured with type IV gypsum (working cast with removable die)*

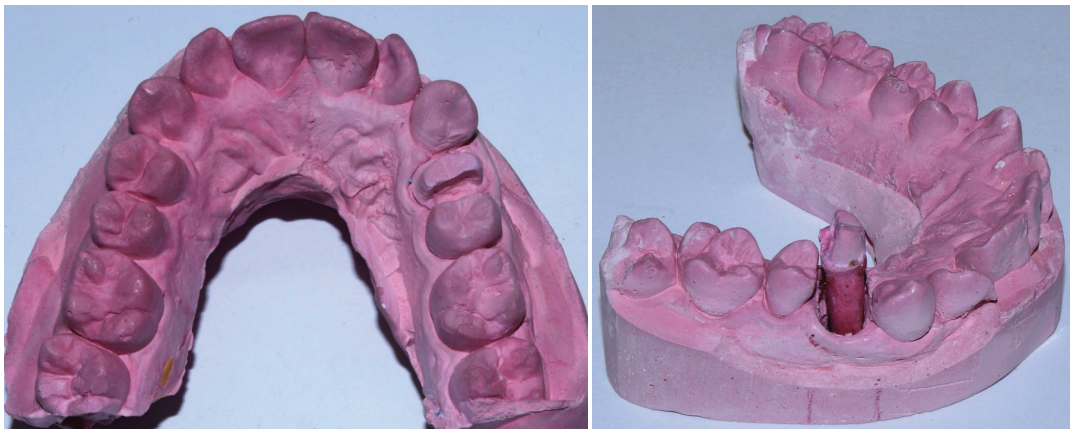

Figure 13 A,B: *Working cast with removable die*

Figure 14: *Layered Zirconia fabricated on Gellar model*

Figure 15: *Layered Zirconia on #24*

DISCUSSION

Subgingival defects in endodontically treated teeth are frequently encountered yet challenging to manage. It is mainly due to limited access and difficulties in maintaining proper isolation during the procedure. There are various treatment modalities for addressing these defects such as surgical crown lengthening, orthodontic extrusion and direct and indirect restoration either with or without deep margin elevation (DME).[7,8] Former two techniques, apically displace supporting tissues. However, it may cause further attachment loss and exposure of root concavities and furcation, dentin hypersensitivity, and unfavorable crown to root ratio as well as compromised esthetics. Moreover, this process may often delay the delivery of the final restoration. [7]

Deep Margin Elevation (DME), on the other hand is a conservative technique to improve accessibility **to deep subgingival margins** which in-turn can predictably bond direct and indirect restorations. However, it poses the risk of violating the biologic width, the need for accurate matrix system and strict isolation protocols which makes it highly technique-sensitive.[7,12] In this case, we opted for a Gellar model to delineate the subgingival margin followed by fabrication of an indirect restoration considering the patients demand for long-term durability at relatively low cost.

The Geller model functions similarly to a working cast with a removable die with an added advantage of preserving the soft tissue details in the cast.9 This allows technicians to visualize the soft tissue contour to which bio-esthetic indirect restorations can be fabricated, thus improving restoration-tissue relationship for a long run. Geller models are particularly beneficial in intricate restorative procedures, such as full-mouth reconstructions, where it is essential to maintain the precise relationship between multiple units.

The armamentarium required for the fabrication of these is readily available and relatively inexpensive. However, in terms of practicality, it is a labor-intensive and time-consuming process, requiring meticulous precision. In the recent years, the process is now digitized and Gellar model can be fabricated using operator friendly digital CAD/CAM technology.[9] This advancement simplifies the fabrication process of the Gellar model, ensuring high-quality outcomes.

CONCLUSION

The Geller model stands out as a method that **effectively preserves soft tissue details while ensuring optimal contouring and marginal integrity** and is both inexpensive and efficient. Despite these advantages, the Geller model as a routine procedure demands high skill, accuracy, and is time-consuming. However, it's considered worth the effort due to the quality of results it produces. However, with the paradigm shift from analog to digital methods, this technique can become less daunting. The integration of digital technology can change the dynamics, making the technique easier to apply and potentially more accessible to practitioners.

ACKNOWLEDGMENT

I would like to express my sincere gratitude to the lab technicians of Dipendra Dental Art. Pvt. Ltd for their exceptional efforts and outstanding work. Their contributions were crucial to the success of this research.

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