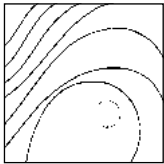


A Three-Die Cast Technique for Duplicating Free Gingival Form in Zirconia Crowns: Two Case Reports



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This report describes a duplication technique of free gingival form from a provisional restoration to a zirconia crown. Three die casts were manufactured from a silicone impression with an acrylic resin ring tray. The first die cast was for the zirconia framework, the second for the provisionalized transfer coping, and the third for relining the provisional restoration. A free gingival impression was taken using a provisionalized transfer coping, and a soft gingival cast was manufactured. The depth of free gingival transparency was measured using a zirconia shade plate. Then, the zirconia framework was customized to allow for subgingival porcelain space. This technique seems to contribute to the clinical-laboratory interface in computer-aided design/computer-assisted manufacture restorations. (Int J Periodontics Restorative Dent 2012;32:e135–e141.)

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Optimal emergence profiles are an important factor in restorative dentistry.^{1,2} In the cervical region of maxillary anterior teeth, a convex form exists on the facial and palatal crown contours. Flatness or slight concavity exists in the transitional line angles, as well as on the proximal surfaces.^{3,4} It has been reported that several gingival responses occur in thick and thin periodontal biotypes when free gingiva suffers from excessive or reduced crown contours.⁵ Considering this and postoperative soft tissue responses, it is necessary to search for an optimal provisional crown contour before definitive crown placement. On the other hand, a retraction cord changes the free gingival form when a silicone impression is taken. Thus, free gingival form in the master cast is different from that of the original form. It has long been desirable to be able to duplicate the original free gingival form on the master cast.^{6–8}

All-ceramic crowns have developed considerably over the past two decades. Recently, zirconia frameworks have received attention as a high-strength nonmetal



Fig 1a At baseline, deficient porcelain-fused-to-metal bonded crowns with unfavorable composite resin filling were evident in the maxillary anterior region.



Fig 1b To fabricate an adequate provisional restoration, 4-0 black silk cords were used to displace the free gingiva at the time of taking the impression.



Fig 1c One week after provisional restoration placement. Although the interdental spaces have been filled, red rolled gingiva and congestive interdigital papillae are evident.



Fig 1d Silicone impression using a resin ring tray using the single-string technique.



Fig 1e First die cast of the left central incisor.

material in computer-aided design/computer-assisted manufacture restorations.⁹ A combination of several factors (porcelain color, zirconia framework color, etc) affects the color of the free gingiva. Furthermore, excessive or reduced subgingival crown contour causes a change in free gingival form and color.⁵ The purposes of this study were to describe a duplication technique of free gingival form from a provisional restoration to a zirconia crown and to introduce a zirconia shade plate technique for the customization of the zirconia framework on the soft gingival cast.

Case report

Patient 1

A 50-year-old woman presented at the authors' office requesting an esthetic occlusal rehabilitation. Deficient porcelain-fused-to-metal bonded crowns were evident in the maxillary anterior region. Unfavorable composite resin filling could be seen in the cervical third of the bilateral central incisors. Accordingly, unesthetic gingival contours with red rolled gingiva were also evident. The periodontal bio-type was thin-scalloped. Probing depths were 2 mm at the mesial

and distal aspects and 1 mm at the facial aspect (Fig 1a). Following initial periodontal therapy and root canal treatment, fiber posts and cores were placed. Orthodontic tooth extrusion was performed at the left central incisor. A silicone impression using a double-string technique was taken to fabricate provisional restorations (Fig 1b). One week after provisional restoration placement (Provinice Fast, Shofu), interdental spaces had been filled, and red rolled gingiva and congestive interdigital papillae were evident (Fig 1c).

Final tooth preparation was performed according to the bot-



Fig 1f Relined provisional restoration of the left central incisor on the third die cast.



Fig 1g Red rolled gingiva and interdental papillae disappeared 3 months after provisional restoration placement.

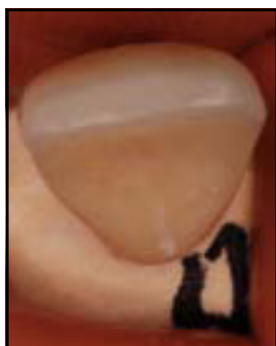


Fig 1h Relined provisional restoration placed on the second die cast.



Fig 1i After taking the silicone impression, the thin transfer coping was placed.



Fig 1j Provisionalized transfer copings placed in the maxillary anterior region.

tom line of the gingival sulcus using 4-0 silk cords. After the single-string technique, silicone impressions (Aquasil Ultra LV, Dentsply) were taken using acrylic resin ring trays. Subsequently, three die casts (New Fujirock, GC) were manufactured from each silicone impression (Figs 1d and 1e). The purpose of the first die cast was to make a zirconia framework, the second to make a provisionalized transfer coping, and the third to reline the provisional restoration.

Die cast for relining the provisional restoration

First, the margin of the provisional

restoration was adjusted on the third die cast. Acrylic resin was then added on the cervical aspect of the die cast, taking into consideration the natural tooth form (Fig 1f).^{3,4} Then, the provisional crown contour was checked in the mouth. Proximal contact was also adjusted to ensure an interdental space of 0.5 mm. Three months after provisional restoration placement, red rolled gingiva and congestive interdental papillae had resolved (Fig 1g).

Die cast to make the provisionalized transfer coping

A provisionalized transfer coping

was manufactured to duplicate the free gingival form from that of the provisional restoration to that of the all-ceramic crown. First, a thin transfer coping using Pattern Resin (GC) was manufactured on the second die cast. Then, a silicone impression was taken from the relined provisional restoration. After removal of the provisional restoration, the thin transfer coping was again placed on the second die cast. Finally, Pattern Resin was used to fill the impression space (Figs 1h and 1i). A pickup silicone impression using the provisionalized transfer copings was then taken (Fig 1j).

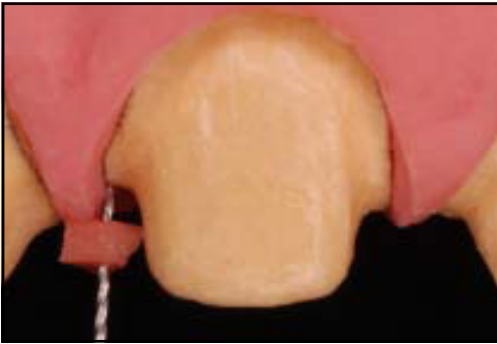


Fig 1k Depth of the subgingival margin was measured using a no. 20 K-file with a rubber stop on the soft gingival cast.



Fig 1l Zirconia frameworks (0.4-mm thick) with reduced subgingival crown contour in the left anterior region.



Fig 1m Gingival transparency was observed using a zirconia shade plate.



Fig 1n One month after zirconia crown placement, no inflammation was evident.

Die cast to fabricate the zirconia framework

Following the pickup impression, a soft gingival cast (Softissue Moulage, Kerr) was manufactured using the first die cast.¹⁰ Measurement of subgingival preparation depth was performed using a no. 20 K-file with a rubber stop (Files K, Zipperer) under 8× magnification. The depth was measured using a digital slide caliper (NTD12-15PMX, Mitutoyo)

(Fig 1k, Table 1). Then, 0.4-mm-thick zirconia frameworks (Katana KT12, Noritake) were assessed to examine the masking effect and soft tissue support (Fig 1l). The masking effect for the discolored teeth was evident in the trial. However, folded red rolled gingiva was observed according to the reduced contour of the zirconia frameworks. Free gingival transparency was also examined at the left central incisor

using a 0.4-mm-thick zirconia shade plate (Katana KT12). A depth of 0.2 mm in the zirconia plate was observed through the free gingiva (Fig 1m). Subsequently, the zirconia frameworks were customized so that the porcelain-zirconia interface was 0.3 mm below the free gingival margin. One month after zirconia crown placement, no inflammation was present (Fig 1n).

Table 1 Depths of the subgingival preparation in patient 1 (mm)						
	Tooth no.*					
	13	12	11	21	22	23
Mesial	1.05	0.27	0.31	1.29	0.47	0.48
Facial	0.57	0.53	0.71	0.63	0.74	0.82
Distal	1.13	0.21	0.30	0.84	0.43	1.14
Palatal	0.44	0.63	0.27	0.73	0.82	0.78

*FDI tooth-numbering system.

Table 2 Depths of the subgingival preparation in patient 2 (mm)			
	Tooth no.*		
	12	11	21
Mesial	0.56	1.17	1.28
Facial	0.77	0.82	0.98
Distal	1.18	0.46	1.05
Palatal	0.66	0.57	0.71

*FDI tooth-numbering system.



Fig 2a Deficient adhesive restorations placed on the bilateral central incisors and right lateral incisor. Interdental spaces were evident.



Fig 2b Two months after zirconia crown placement, interdental papillae were filled, and no inflammation around the zirconia crowns was evident.

Patient 2

A 61-year-old woman presented at the authors' office requesting esthetic improvement in the maxillary anterior region. Deficient adhesive restorations were evident on the bilateral maxillary central incisors and the right lateral incisor. The periodontal biotype was thin-scalloped. Probing depths were 2 mm at the mesial and distal aspects and 1 mm

at the facial aspect. Interdental spaces were evident because the patient had received instructions on interdental brushing at her previous dental office (Fig 2a). Following initial periodontal therapy, provisional restorations were placed. Three months later, the interdental papillae had increased. The final provisional crown contours had been transferred using the three-die cast technique. The soft gingival cast

was manufactured, and subgingival preparation depths were measured (Table 2). Free gingival transparency was 0.1 mm at the left central incisor. Zirconia frameworks were customized so that the porcelain-zirconia interface was 0.2 mm below the free gingival margin. Two months after zirconia crown placement, interdental spaces had closed. No inflammation was present around the zirconia crowns (Fig 2b).



Discussion

The role of a provisional restoration is to protect the prepared teeth and prevent tooth migration. More importantly, an optimal crown-gingiva interface and a well-fitting provisional restoration allow the periodontal tissues to remain or become healthy.^{11,12} A direct relining technique is usually performed to optimize the crown contour and improve marginal accuracy after finalizing tooth preparation.² However, some studies have pointed out that an indirect technique has superior marginal accuracy versus a direct technique.^{13,14} An accurate transfer method of the final provisional crown contour has long been desired.⁶⁻⁸

An acrylic resin ring tray with a silicone impression is an accurate system for manufacturing a master cast, as is a copper ring tray with a polysulfide impression.¹⁵ It has been reported that the accuracy of three repeated-pour casts is stable in silicone impressions.¹⁶ The purpose of the three-die cast technique is to duplicate the original free gingival form. The gingival retraction cord technique causes changes in free gingival form of the master cast. A pickup impression using an acrylic resin transfer cap or a zirconia framework is sometimes used to duplicate the free gingival form. However, those forms are technically different from those of a provisional restoration. The provisionalized transfer coping on the second die cast mirrors the crown contour of the relined provisional

restoration on the third die cast. Thus, the soft gingival cast fabricated using the first die cast duplicates the free gingival form with the final provisional restoration.

Both strength and esthetics must be considered in the customization of zirconia frameworks. Recently, some colored 0.4-mm-thick zirconia frameworks have become available for the anterior region. The color of the zirconia framework is determined by porcelain color matching. An exposed or see-through zirconia framework may cause a poor esthetic result. The critical area is the zirconia-porcelain interface in the free gingiva. However, free gingival form changes immediately after crown removal. Thus, it is difficult to accurately measure the depth of the subgingival preparation in the mouth. The soft gingival cast using the provisionalized transfer coping duplicates the original free gingival form. Thus, it is feasible to measure the depth of the subgingival preparation. Free gingival thickness affects its transparency.¹⁷ The method using a zirconia shade plate is a simple way to measure the depth of free gingival transparency for subgingival porcelain spaces.

Conclusion

The free gingival impression system using the three-die cast and zirconia shade plate techniques seems to contribute to the clinic-laboratory interface in computer-aided design/computer-assisted manufacture restoration.



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