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Digital impression of teeth prepared with a subgingival vertical finish line: a new clinical approach to manage the interim crown

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ABSTRACT

Aim Intraoral scanner can simplify the prosthodontic workflow with reduction of time, cost and several steps. However, clinical conditions can affect the quality of the digital impressions, especially if the tooth is prepared with subgingival vertical finish line. This report describes a technique to manage the interim crown by means of a case report.
Case report A 63-year-old female patient needed to be treated with a single-unit fixed dental prosthesis in the posterior area. A new technique to manage the interim crown and to obtain accurate digital impression of an abutment tooth with subgingival vertical finish line without the use of retraction techniques is described.
Conclusion This method allows the control of many problems associated to digital impressions such as localized bleeding, retraction technique and limits of scanners to acquire subgingival vertical finish line.

KEYWORDS: Digital impression, Abutment tooth, Vertical finish line, Interim Crown, Intraoral scanner

INTRODUCTION

Definitive impression is the main step in the prosthodontic workflow. Traditional impression with different techniques and materials represents a commonly used procedure in dentistry (1,2), but with the introduction of intraoral scanner (IOS) many steps have been eliminated with reduction of time and cost (3-5). In literature, different researches demonstrated the accuracy of digital impression for single dental crown (6) or full-arch (7), but no article described the clinical steps to obtain an accurate digital impression, especially if the tooth is prepared with subgingival vertical finish line (8). Gingival displacement is essential to create sufficient space between the finish line and the gingival tissue to obtain an accurate impression (9). However, retraction techniques can cause gingival bleeding, be time-consuming and affect saliva flow rate. These clinical events affect the quality of the digital impression of an abutment tooth. The purpose of this article was to describe a clinical workflow to obtain accurate digital impression of an abutment tooth with subgingival vertical finish line without the use of retraction techniques by means of a case report.

CASE REPORT

A 63-year-old female patient needed to be treated with a single-unit fixed dental prosthesis in posterior sector (tooth 1.4) after endodontic treatment. The patient presented a thick gingival biotype and the treatment plan was to prepare the abutment tooth with subgingival vertical finish line and to receive a monolithic zirconia crown. Before the abutment tooth preparation, an irreversible hydrocolloid impression (Blueprint Creme; Dentsply) was performed to fabricate an interim crown with polymethyl methacrylate (Top.ling professional, Bredent) by a dental laboratory (Fig. 1). Probing and measuring the depth of the gingival sulcus were accomplished to locate the cementum-enamel junction (CEJ). Vestibular, palatal and occlusal surfaces were reduced of 1-1.5 mm using at first a green ring (Komet Dental S6368023) and subsequently a red ring (Komet Dental 8368023) rugby diamond bur. The axial walls were reduced with a covergence angle of 10° of 1 mm. Feather-edge cervical preparation margins were placed 0.5-1 mm


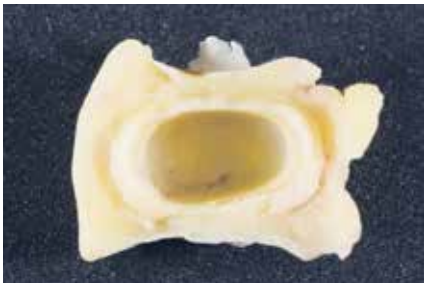
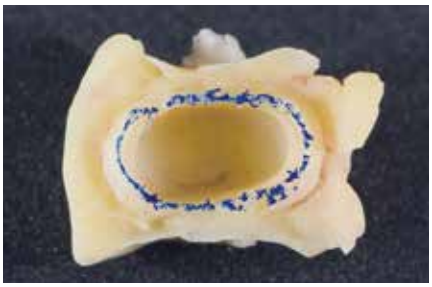

FIG. 1 The interim crown. FIG. 2 Interim crown after relining with autopolymerizable acrylic resin. FIG. 3 Circumferential areas: the first (blue) determined the gingival sulcus of the abutment tooth, while the second (external) repeated the position of the gingival margin.

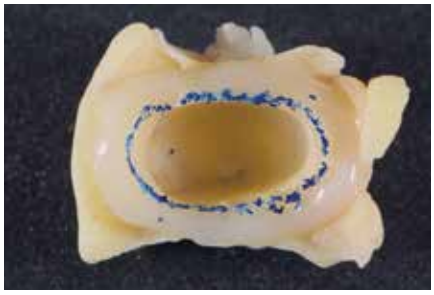
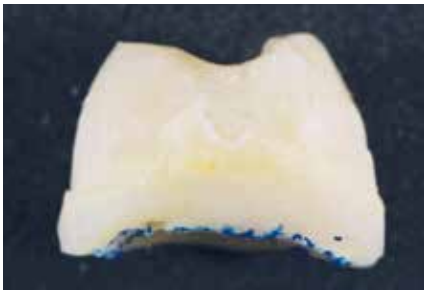


FIG. 4 Photopolymerizing flowable composite resin is used to fill the groove. FIG. 5 First step of management of interim crown. Remove the excessive material with tungsten bur. FIG. 6 Second step of management of interim crown. Connect the two circumferential areas with a 45° angle.

subgingivally following the cementum-enamel junction using initially a coarse grit (Komet Dental S6862012) and subsequently a red (Komet Dental 8862012) ring tapered diamond bur (10-12). After verifying the fit and isolating the abutment tooth with glycerine, the interim crown was adapted and relined with autopolymerizable acrylic resin (Paladur-Kulzer) to penetrate the gingival sulcus in apical direction (Fig. 2).The relining procedure created two circumferential areas: the first determined the gingival sulcus of the abutment tooth, while the second (external) repeated the position of the gingival margin. A groove was formed between the two circumferential areas: this groove represented the distance between the gingival margin and the feather-edge cervical preparation margin (Fig. 3). The groove was filled with a photopolymerizing flowable composite resin (Filtek Supreme XTE flow; 3M ESPE) to create a new cervical emergence profile (Fig. 4). The excessive material was removed and the two circumferential areas were connected with a 45° angle using a paper disc and tungsten bur (Komet Dental; H250NEX) (Fig. 5, 6). The interim crown was accurately polished using a fine rubber polisher bur (Komet Dental, 94018F) (Fig. 7). The thickness had to be at least 1 mm. New angular components were created with a new CEJ. The interim crown was located at a depth of 0.5 to 1 mm into the gingival sulcus, respecting the biologic width. The interim crown was cemented using an eugenol-free provisional cement (Temp Bond; Kerr) on the abutment tooth. After five minutes, the interim crown was removed using a pean caliper (Fig. 8) and the excess cements was eliminated on the abutment tooth and on the temporary crown outside the mouth. After polishig, the activator of the provisional cement was applied inside the interim crown and it was placed on the abutment tooth (Fig. 9).



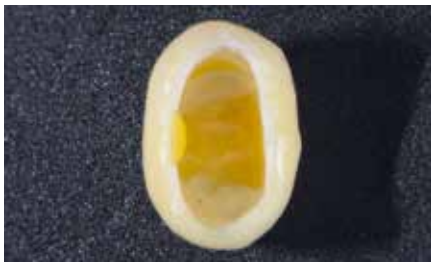

FIG. 7 Third step of management of the interim crown. The interim crown was accurately polished using a fine rubber polisher bur. FIG. 8 After cementation, removal of the interim crown outside the mouth to clean the excess cement. FIG. 9 Application of the activator of the provisional cement inside the interim crown.

FIG. 10 Occlusal view of the abutment tooth after removal of the interim crown and before the digital impression.

FIG. 11 Digital impression of the abutment tooth.

After 40 days, the digital impressions were produced using a True Definition® scanner (3M, software version 5.1.1). Titanium dioxide powder (3M) was applied to the teeth before the scanning also on the temporary crown. The interim crown was removed using a pean caliper (Fig. 10); the powder was reapplied on the abutment tooth and the scanning procedure was accomplished within 2 minutes before gingival collapse. Once the abutment tooth had been scanned, the teeth in the same quadrant were scanned (Fig. 11). After scanning the antagonists, a buccal scan with teeth in maximum intercuspation position as a bite registration was performed. During scanning a dry field was maintained using a dental aspirator.

DISCUSSION

Identifying the finish line in an abutment tooth represents a critical step in prosthodontics, especially in the case of subgingival vertical finish line. The limitations of the intraoral scanner (access and scanning angle) combined with the presence of gingival crevicular fluid and localized bleeding may negatively affect the quality of a digital impression (13). In this article it is described a workflow to use the interim crown to obtain an accurate digital impression without retraction techniques. The thickness of the prosthetic margin and the removal of the excess cement outside the mouth are the two main features of this workflow. The thickness of a prosthetic margin is increased of 1mm with photopolymerizing flowable composite resin and polished with angle of 45° to guide the gingival remodelling. With this step, gingival tissue maturation moves in external-coronal direction and it adapts to new forms of interim crown. In this way, when the interim crown is removed the gingiva is already displaced without any retraction technique. However, the clinicians have two minutes to scan the abutment tooth before gingival collapse.

The second characteristic of this workflow is the cement removal technique. Many clinicians remove the cement inside the mouth of a patient, but it is difficult to understand if all the excess cement has been removed, especially in the gingival sulcus. Several studies demonstrated that excesses of cement can produce inflammation and biological complications of gingiva around the abutment tooth (14). In this technique the operator removed the interim crown outside the mouth after cementation to clean the excess cement. This step allows to remove all the cement in every area enabling optimal healing of gingiva, long-term stability of the gingival tissues and preventing localized bleeding. The method descripted in this article is complex and clinically more time-consuming, but allows the control of many associated problems as localized bleeding, retraction technique and limits of scanners to acquire subgingival vertical finish line. However, the clinicians with poor experience to prepare abutment tooth with subgingival vertical margins may cause gingival recession and may compromise aesthetics. Therefore, a correct technique for the management of the interim crown is fundamental to make an accurate impression with both digital and traditional workflows.

CONCLUSION

This article describes a technique to manage interim crown of teeth prepared with a subgingival vertical finish line. This method allows the control of many associated problems for digital impression as localized bleeding, retraction technique and limits of scanners to acquire subgingival vertical finish line.

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