



The Use of a Completely Digital Flow in the Fabrication of Single Crown on a Root Resected Molar. A Case Report up 3 Years of Follow-Up

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Abstract

A 443-y male in good general health with a failing maxillary first molar due to a fractured mesio buccal root was treated with the resection of the root. After placing the interim restoration, tissues were allowed to heal for 6 months. Impressions were made with an intraoral scanner and the double cord retraction technique. The crown was fabricated with an entirely digital workflow, without the use of models. This procedure allows the optimization of the prosthodontic treatment phases, thereby reducing time and costs.

Keywords: Fabrication; Crown; Root Resected Molar

Introduction

When implants did not yet exist, one of the treatment strategies for multirrooted posterior teeth with furcation involvement, or problems to a root was root resection with separation or amputation of the roots. Some authors have proposed the same technique to salvage otherwise hopeless teeth, with good results when it was used as an elective and not as a last resort procedure [1-4].

Root resective procedures comprehend root amputation, in cases where one or more roots are removed, and root separation, where the roots are retained but separated from one another so that the tooth crown is supported by individual roots and the furcations are left completely open so that oral hygiene can be performed. This type of treatment was relatively common in a time

when the only real alternative was a removable denture. A part of these cases were treated with complex restorations, typically performed porcelain fused to metal or gold resin and visible metal margins [5-9]. Treated molars were usually splinted at least with the more mesial abutment in the attempt to limit periodontal mobility, and often restorations included many teeth.

Material and Method

The patient, a 43-y old male, with negative anamnesis presented pain to mechanical stimulation of the left upper first molar. The clinical examination reveals slight mobility (0-1), and vestibular fistula (Figure 1-3). The initial treatment plan is motivation and instructions on how to manage oral hygiene procedures, complete set of radiograph, periodontal charting, scaling and root planning.



Figure 1



Figure 2

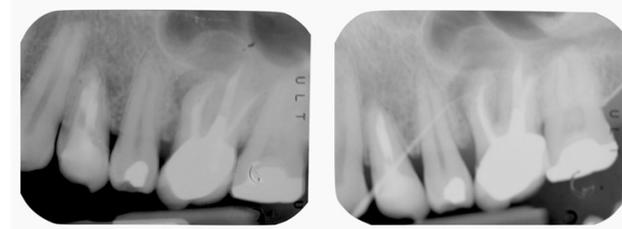


Figure 3

- **Diagnosis:** gingivitis, recessions, displastic enamel, periapical lesion on mesio -buccal root of the first left maxillary molar. Deep probing depth in a limited area of the mesial aspect of the tooth.
- **Prognosis:** prognosis of tooth 2.6 is uncertain. There may be a fracture; it is necessary to remove the existing porcelain fused to metal crown. After crown removal the presence of a fracture in the mesio-buccal root is confirmed.

The following possible clinical alternatives for the treatment plan of this case [9-14].

- Extraction and immediate, early, or delayed implant placement. It should be noted that in this specific case it would seem that a sinus lift could be necessary, either with a crestal or lateral approach. (Foto rx preoperative).
- Extraction and fabrication of a three unit bridge
- Extraction and fabrication of a removable partial denture
- Root resection and extraction of the mesio. buccal root of the left upper molar with or without splinting the molar to the second bicuspid.
- no treatment

Definitive treatment crown removal, removal of the amalgam restoration, root canal treatment, post and core restoration, root resection of the mesio-buccal root, placement of an interim restoration (Figure 4). The tooth was prepared with a feather edge margin having care to eliminate all undercuts. As suggested in previous papers [15], the tooth was initially prepared with a medium coarse 100 micron grit (Komet brasseler 862-16 and 12), amants and further finished with fine grit rotary instruments of the same form. (Komet- brasseler 8862 012).



Figure 4

After 6 months of healing, impressions were made with the double cord retraction technique, using both 000 and 1 size cords impregnated with astringent liquid. (Figure 5, 6). Digital impressions made with intraoral scanner (Carestream cs3600 software 7.0.23). (Figure 7-9). The original scan file was converted from the original proprietary file (CSZ) to STL and the restoration digitally designed with Exocad software. (Figure 10-12).

The zirconia monolithic crown was fabricated using an entirely digital workflow, and a model-less procedure. The restoration was personalized and hand polished.

Simplified cementation procedure using resin cement (Panavia V5). Follow up 36 months. (Figure 13, 14).



Figure 7

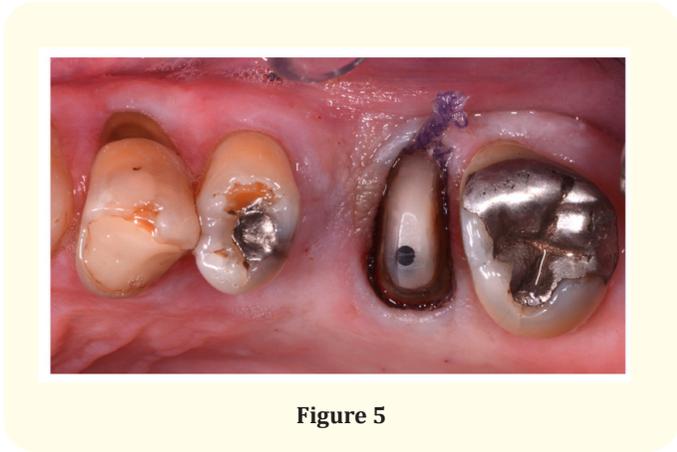


Figure 5



Figure 8

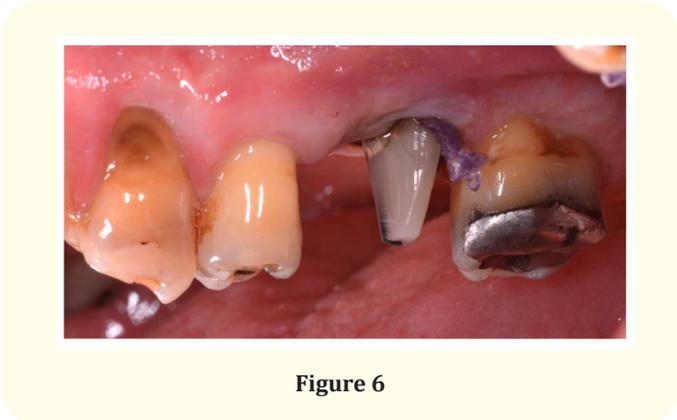


Figure 6

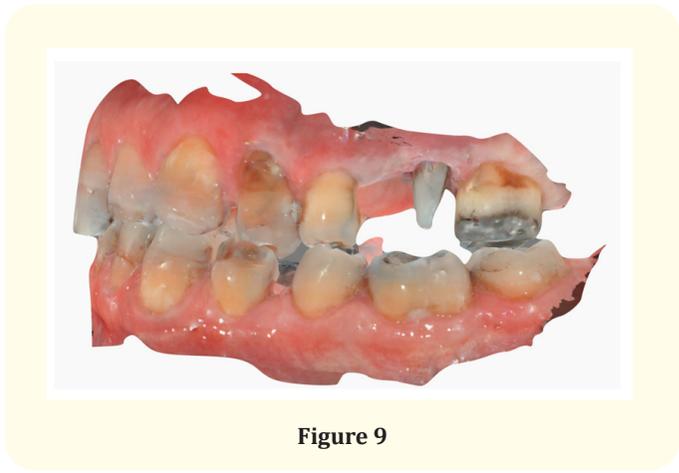


Figure 9

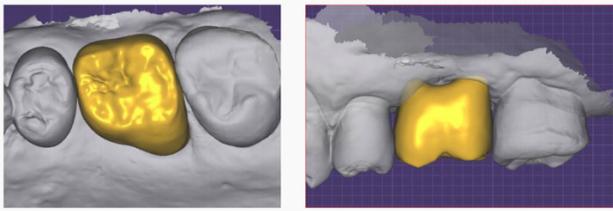


Figure 10



Figure 14

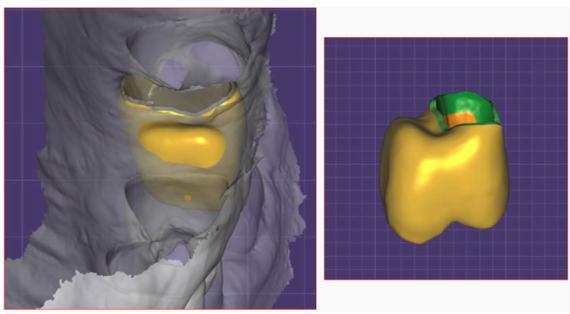


Figure 11

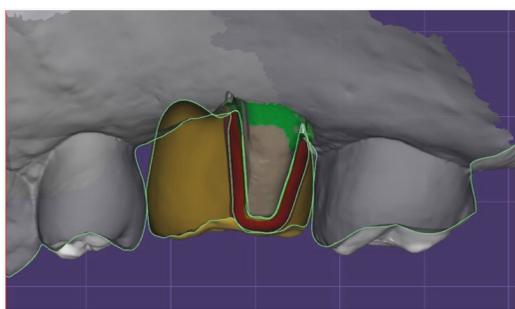


Figure 12

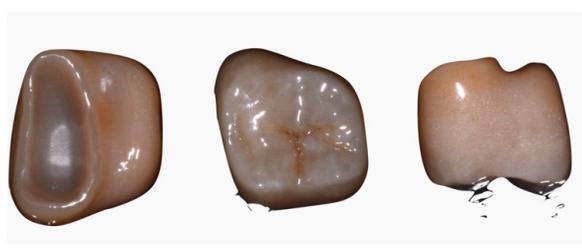


Figure 13

Result and Discussion

There are several clinical alternatives when a multirouted tooth has a problem related to a single tooth or furcation, and the clinical approach may vary depending on whether the tooth is considered hopeless or not. If the tooth is clinically hopeless the alternative treatment plans consider extraction and a replacement, which can be supported by teeth (for example a three- unit bridge or a partial removable denture) or an implant. Viceversa, if the tooth is not considered hopeless, in order to retain the tooth root resective procedures can be a valid alternative.

Implant supported restorations are quite popular and for many good reasons, as they undoubtedly offer several advantages. Given sufficient bone is present, implants are a relatively easy although expensive procedure that allows clinicians to replace hopeless teeth. Clearly, the clinical definition of hopeless is a personal one, and therefore biased in nature. It reflects the experience and knowledge of the clinician. With the introduction of implant supported restorations, some more complex treatment procedures such as root resective procedures started to seem somehow outdated and more at risk than implant surgery [16-20].

It should be noted however, that most of the least favorable outcomes of root resective procedures are relative to complex long spanning restorations, which used to be proposed in a pre-implant era, or in cases where these procedures are used as a last resort, for example to recover failing teeth without removing existing restorations. Single tooth restorations on teeth that were treated with root resective procedures have shown good results, comparable with data on single crowns on implants when one root was amputated, or all roots were retained and separated [21,22]. A retrospective study was recently published with single crowns retained from single rooted resected molars, with good results, comparable to those of crowns retained from non- resected molars within ap-

proximately 7.5 years of follow-up [23]. The feather edge preparation has been successfully used by many authors with different kinds of materials, including metal, lithium disilicate, and zirconia [24-27]. This type of margin geometry can be used to eliminate all undercuts deep into the tissues, down to the bone crest when the tooth is prepared after elevating a flap, or to the connective tissue attachment when no flap is raised, such as in this case. The dental technician will in any case have a margin area rather than a single finish line in which to place the restoration margins. Multirouted teeth treated with root resection it is mandatory to perform endodontic treatment. It is therefore very important to prepare the tooth deep enough into the sulcus in order to allow an intrasulcular placement of the margins, otherwise the margins could end up being extrasulcular, which could generate an esthetic problem if the residual dental tissues are exposed because they could be darker than normal.

The preparation procedures should include fine grit finishing in order to achieve very smooth surfaces, this is especially important when digital impressions are made. The optical impressions are comparable to if not better than traditional analog impressions [28-31]. Nevertheless, the type of intraoral scanner used, the scan strategy, and the operator skill still play an important role [32,33], and the clinical results are worse than those obtained *in vitro* [34].

The anatomy of the restoration is another important factor. The cad design includes an ovoidal shape in the area of the missing root and a false root in order to guide interproximal brushing in the area.

The occlusal design has also been modified in order to place the occlusal contacts in the area of the tooth supported by the roots rather than the mesial crest, as shown in previous article [23].

The case shown in this report is now in a follow-up of 3 years as a success, with no modification since cementation of the Zr crown, hand polished in order to get best outcome [35].

Conclusions

The combination of root resection on a multi rooted single tooth and a digital work flow allows a reduction of biological cost and a simplification of the prosthetic treatment plan, and is a valid and predictable alternative to the placement of an implant.

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Conflict of Interest

Authors declare no financial interest or any conflict of interest exists for this article, materials and methods.

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