CASE REPORT

Restoration of molar morphology with a split cast post and core

CONSTANTIN DĂGUCI1), LUMINIŢĂ DĂGUCI2), MARILENA BĂTĂIOSU3), VERONICA MERCUŢ2), PETRA ŞURLIN9), ADINA MAGDALENA BUNGET5), MIHAELA JANA ŢUCULINĂ6), MIHAELA RĂESCU7)

1)Department of Oral Health, University of Medicine and Pharmacy of Craiova, Romania
2)Department of Dental Prosthetics, University of Medicine and Pharmacy of Craiova, Romania
3)Department of Pedodontology, University of Medicine and Pharmacy of Craiova, Romania
4)Department of Parodontology, University of Medicine and Pharmacy of Craiova, Romania
5)PhD student, Department of Histology, University of Medicine and Pharmacy of Craiova, Romania
6)Department of Odontotherapy, University of Medicine and Pharmacy of Craiova, Romania
7)Department of Preventive Dentistry, “Titu Maiorescu” University, Bucharest, Romania

Abstract
The teeth with extensive coronal destructions due to carious process can be saved by using split cast post and core. This technique has been used for a long time and with positive results recognized by many authors. The clinical case presented here describes indirectly the reconstitution technique with split cast post and core with latch of a maxillary molar with divergent roots and extensive coronal destruction both in area and depth.

Keywords: divergent roots, gingival morphology, coronary reconstruction.

Introduction
The conservation of a molar with high coronary destruction is influenced by a number of parameters: correctness of the endodontic treatment, the amount of remaining dentin, the degree of implantation of the root, the volume and their convergence, the type of reconstruction which was used, tooth position in the arch and the number of adjacent teeth [1, 2].

Due to the fact that the remaining coronal dentin level is minimal, we chose to restore the coronary morphology for a split cast post and core, which although induces stress at the level of the dentin it is stiffer and stronger, the results using this type of restoration is familiar for many authors [3–5].

The difficulty of the case consisted of the fact that, due to extensive coronoal damage, extended both in surface and depth, the pulp chamber floor at the level of the mesio-buccal root was much diminished, thus there is a risk of fracture. We decided to remove the affected mesio-buccal root, by root amputation, to preserve and use the other two roots for a crown-root reconstruction.

Patient, Methods and Results
Patient V.S., 40-year-old, presents himself to the dental office with symptoms of acute apical periodontitis at the tooth 24, requiring its extraction and further prosthetic treatment at the level of the maxillary arch to restore masticatory function. Following clinical examination, we observed an inflammation of the gums around the mesio-buccal root. Outside this zone, the periodontal status is normal. The patient has a good oral hygiene. He is not under medical treatment and denies having any other general conditions.

The patient wants its conservation disagreeing the treatment plan with prosthetic treatment with partially mobilized prosthetic that can protect the terminal edentulous denture that would have resulted from the extraction of 27. He gives his consent to the proposed treatment plan, after being informed about the benefits and the risks of this plan. The patient stated that an intervention of the root canal was previously performed at the level of the 27, without specifying the time when this happened. After making dental retro-alveolar radiography, we observed an incorrectly endodontical treatment at the level of the disto-buccal and palatal roots and the absence of any treatment for the mesio-buccal root canal (Figure 1).

However, due to extensive damage of coronary area, extended both in surface and depth, the pulp chamber floor at the level of the mesio-buccal root canal was much diminished, having a high risk of fracture. Before removing the mesio-buccal root by-root amputation, we retreated correctly the disto-buccal and palatal roots. The permeability of the root canals was easily made using Kerr files, because, at this level, we have not found gutta-percha cones. Both root canals were irrigated with 3% sodium hypochlorite. After the chemo-mechanical treatment, we applied medicinal dressings using Rockle’s solution and definitive treatment was performed using lateral condensation technique of gutta-percha and AH 26 paste (Figure 2).

To restore the coronary bont at the level of tooth 27,
we opted for a crown-root device on which we will insert a crown. The creation of this device presents some peculiarities due to divergent direction of the crown root canals in which the aggregation of the device is about to be made. The aggregation is usually performed in the area created in the two roots. We opted for crown-root reconstruction with latch split cast post and core, which is commonly used on pluriradicular teeth with extensive coronary destructs and divergent roots. We generally chose the most voluminous root canals, in this situation the remaining root canals after amputation. The preparation of the root places was performed after chemo-mechanical treatment of both root canals and their filling, but before the root amputation performance (Figure 3).

Due to the difficulty of creating accurately these two components, the box shaped like a dovetail and the latch, made of self-curing acrylic, we opted for the indirect method, the creation of the two components obtained in the dental lab. The root area required to aggregate these two crown-root devices are created by further widening the palatal root canal and the disto-buccal one, started during permeability phase. The continuous preparation of root canals is done with drillings type Peeso so that, finally, the root areas should have a length of about 2/3 of the length of the roots and a diameter of 1/3 of the diameter of the root at all levels. Peeso drills offer the greatest security due to blunt tip that helps to center the drill in the root canal. We started widening the channel with 0.6 mm in diameter drill, and we finished it with 1.4 mm diameter drilling, reaching a maximum diameter that can be used for molar 27. The length of the two radicular areas, the two crown-root devices respectively must be at least equal to the height of future crowns, but less than 2/3 of root length not to get too close to the apex. The shape of the two radicular latches on vertical sections is conical, with the tip toward the apical, and within horizontal section, it reproduces the radicular circumference. This form provides a uniform thickness of radicular walls, which favors stability of prosthetic construction and the reflation of the cement fixation introduced in the two root lodges. We prepared in a non-adherent manner the root sectional area, and have adapted to the two radicular latches two pivots made of acrylic whose length does not exceed the occlusal plane.

We isolated the two root areas and introduced at their level fluid consistency silicone. We inserted two pins made of acrylic at the level of the radicular latches, and we have taking an impression of the entire dental arcade with high consistency silicone. After the impression, we observed an intimate recording of the radicular places and of the root-sectioning surface and the divergent direction of the two radicular canals (Figure 4).

In a first stage, the model of a component, in this case the latch was realized from calibrated wax. We did test it both on a model and in the oral cavity to observe the adaptation of both the surface level and the surface of the root section. The wax model is packed and thus the metal component is obtained, opting for making it from a Cr–Co alloy that provides corrosion resistance and mechanical strength (Figure 5).

We have retried it at the level of the root area, and after its proper set, the wax model of the second component was created (Figure 6).

The second component is being assembled and the obtained wax model is poured, and then the two metal components are tested on the root area (Figure 7).

The two metal components adapt well both on coronary and root level, and their assemble at the latch level is made correctly, so we proceeded to reconstruct with glass ionomer Fuji Plus cement (Figure 8).

In order to restore the maxillary arch, the patient opted for porcelain mixed bridge, totally esthetic, which combines strength of cast metal with very good aesthetic of the physiognomical component. The reduction of the occlusal surface was achieved by following well-defined plans, with reproduction of the occlusal morphology or the basic geometric shape of the occlusal surface (Figure 9).

We performed a temporary prosthesis of the prosthetic field, a mandatory step for teeth with deficient dental periodontal support, through a temporary bridge made of acrylic thermopolymerized resins, maintained by the prosthetic field for a period of about 6–8 weeks, which had aesthetic qualities and better wear and fracture resistance than those of self-curing resins (Figure 10).

After a period of 6–8 weeks, a model checking of both the volume and contours of dental bridge is made, of the preparation adaptation both in the cervical area and also the occlusal relationships, following the clinical verification stage of the adaptation on the prosthetic field of the dental bridge (Figure 11).

On a careful examination of the remaining teeth group, it becomes obvious that the canine is more able to with-
stand the horizontal forces that occur during eccentric movements of the mandible.

The canine guide, used as occlusal scheme in this case, helps to reduce the action of horizontal masticatory forces at the level of the distal abutment teeth (Figure 12).

Discussion

To achieve and insert at the level of oral cavity a piece of fixed prosthetic, the dentist must determine the periodontal status of the teeth [6]. The eviction and the extraction portion of one of the roots with or without the crown change the tooth morphology and, therefore, the area of the root furcation. The restoration of that area architecture must be obtained through a conservative removal of alveolar bone to restore and maintain a healthy periodontium without being affected by cervical limit of a crown, so the prosthetic restoration can be biologically accepted. The root amputation, as a surgical technique is very helpful in preserving a posterior tooth at which an affected root may endanger the entire tooth. The main factor of stress is the fact that the elimination of one of the roots, often accompanied by its crown portion, leads to changing the shape of the crown that will be used to cover the tooth. The existence of large coronary destructions due to carious process, at the clinical crown level of a maxillary molar, creates particular difficulties for retention of a restoration without its remaining dentin. In this case, the retention of the root canal restoration is a necessity [7]. We had to remove the thin and slightly high edges of residual dentin, because they did not provide sufficient strength for coronary reconstruction, a thing also shown by other authors [7].

In this case, the surface of the root sectioning is at the level of the marginal gingiva.

Many authors confirm the existence of the so-called ferrule effect, which reduces the incidence of crown reconstruction fracture of vital tooth crowns [8–10]. Other authors argue that there is a coronal extension of the edge of the remaining dentin of at least 1 mm above the surface of the root section, which doubles the resistance to fracture of the reconstruction versus the absence of the remaining dentine at the level of the surface section [11, 12].

Another important factor to be taken into account for making a split cast post and core is the correctness of the preparation of the root area. There are authors who
believe that the length of the radicular places should be at least equal to the coronal portion of the reconstruction, but keep a distance of 4–5 mm from the apical constriction to maintain a proper sealing of the root canals [13]. Other authors claim that the removal of excessive dentin should be avoided when preparing root area to avoid fractured roots [14–16]. Studies made by Johnson et al. and Trabert and Cooney, when two posts are used, can do a departure from the rule that says that a post must have a length of 2/3 of root length and 1/3 of its diameter [17, 18]. Using a double post ensures both adequate strength and stability for coronary reconstruction.

A major factor affecting the success rate of the design is the post design, Torbjörner et al., made a comparison of the rates of failure regarding the parallelism or the divergent position of the root posts [19]. The study shows a slight increase in the failure rate for the parallel in contrast with diverging posts. At the same time, the loss of the retention was the most common cause of failure for both parallel and divergent posts [19].

Another important factor that compensates for the insufficient root area length, the retention of root device implicitly is the use of acrylic resin-cement that stabilizes the tooth.

In vitro studies were conducted to demonstrate that the resistance to fracture of the roots, which have been cemented to the posts using acrylic resin-cement, was significantly higher than in the case of using zinc phosphate cement [20, 21]. For fixing the two posts, we used Fuji Plus ionomer cement (GC America Company), which has high resistant, had excellent biocompatibility, low rate of secondary caries.

In fact, some authors claim that the type of fixing for the posts is more relevant than the design itself [22]. In order to achieve the two posts, we used a Co–Cr alloy to provide both high strength and retention as compared to other types of posts [23].

One of the factors with a potentially harmful risk for the periodontum is the placement of the prosthetic pieces edges at an incorrect limit to the gum [24]. As for the present clinical case where the surface of the root section is at the same level with the edge of the marginal gingiva, the crown margin was placed under the gum to cover the junction between the material used for the coronary device and the remaining tooth structure.

Several studies have shown that the position of the crown edge in relation to the gingiva, can significantly affect the gingival index, like with periodontal pockets and their relationship with epithelial tissue [24]. The clinical case presented here, placing the restored margin in the gingival sulcus was made through a very good adaptation and finishing, as well as by intrasulcular contours, which reflected the morphology of gingival sulcus [25].

In terms of occlusion reports for the side part, Kois and Spear recommends, that in case of dental bridges on side areas having abutment teeth with dental-periodontal support deficient due to root amputation, to achieve a minimum over-coverage and an occlusal morphology with a less pronounced relief [26]. We designed an occlusal scheme in which we preserved the pronounced form of the occlusal surfaces with well-defined cusps in mesial areas of prosthetic bridge, decreasing progressively toward the distal cusps, being nearly eradicated at the level of 27 who received root amputation.

D’Amico sees the canine like a switch with occlusal stress because of its numerous proprioceptors, which determine a reduction of masseter and temporal muscle activity into movements of jaw laterality, thus he actually formulates the occlusal concept known as canine guidance [27].

Conclusions
The crown applied at the level of 27, it must protect the remaining tooth structure and contribute to the maintenance of periodontium health. Important at this stage is the fact that the crown margin must exceed apically the junction between the teeth and the coronary device to prevent tooth fracture and decementation of the dental bridge. The placement of prosthetic restored margins against gingival sulcus requires the presence of healthy marginal gingiva and the knowledge of gingival sulcus morphology. The prosthetic reconstruction success and sustainability in time of both this surgery and this type of split cast post and core heavily depends on occlusal scheme to be used for prosthesis of two edentulous spaces.

As a posterior abutment tooth, one preserved root can make the difference between fixed and mobile prosthesis.

Contribution Note
All authors have equal contributions to the study and the publication.

References
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Corresponding author
Constantin Dăgucă, Lecturer, MD, PhD, Department of Oral Health, Faculty of Dentistry, University of Medicine and Pharmacy of Craiova, 2 Petru Rareș Street, 200349 Craiova, Romania; Phone +40728–272 222, e-mail: dagucicristi@yahoo.com

Received: November 16, 2013
Accepted: April 25, 2014