Treatment of Grade III furcation involvement in upper molars: Case Series with 2–16-year follow-up

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Abstract:
Frequently, the clinicians are addressed to decide between the preservation of Grade III furcation molar and the implant replacement, due to the increased access among the population to this therapy over the years and high success rate of the osseointegrated implants. This case series presents clinical and radiographic data collected from 10 patients who underwent 13 root amputations for the treatment of degree Grade III furcation in maxillary molars with follow-up until 16 years. The results showed improvements in probing depth, bleeding on probing, and radiographic aspects. The follow-up time indicates that root amputation is an effective long-term treatment solution, especially when the patient’s local, systemic, or financial conditions make it difficult or impossible to implant placement.

Key words:
Follow-up studies, furcation involvement, periodontal surgery, root-resective therapy, upper molars

INTRODUCTION

The periodontal attachment loss due to periodontitis may result in teeth with furcation involvement, causing degree I, II, or Grade III furcation defects, based on the horizontal component of the bone defect, where degree Grade III is totally horizontal destruction throughout the furcation.[1] In patients with periodontal disease, it is very common to find teeth with furcation involvement, with a prevalence of 13.7% in the general US population[2] and present in 30%–50% of periodontitis cases.[3] Furthermore, in a Swedish adult population, the prevalence of II/Grade III furcation-involved molar is 8.3% with the maxillary molars showing a greater number of furcation involvement.[4] Because of the unique anatomical characteristics of the furcation and inability related to plaque control by the patient and the professional, multi-root teeth with furcation involvement require specific treatments.[5] Posterior teeth are frequently lost, and one of the reasons is the presence of furcation lesions, which are still a challenge within the dental clinic.

The diagnosis of furcation involvement is realized by periodontal probing and radiographs. The assessment of morphological aspects on multi-rooted teeth such as the height of the root trunk and the root divergences imply to select the resective therapy. Furthermore, short root trunk can be affected by the progression of periodontal disease earlier, and both vertical and horizontal components in furcation involvement are associated with tooth loss.[6] The therapeutic approach to be followed depends on the severity of the disease; the amount of remaining bone support, length, shape, and divergence of roots, that is, a detailed diagnosis and all these factors, must be taken in consideration.

The treatment modalities of teeth with degree Grade III furcation involvement are tunneling, resection, and extraction. Even though regenerative therapy could be an approach for furcation defects, especially in II furcation involvement, there is no scientific evidence showing predictably outcomes with this therapy for Grade III furcation defect.[7] Then, this therapy is not a predictably indicated for Grade III furcation involvement, that is, the focus of this case series. When considering only the maxillary molars, as we showed in this case series,
tunneling is not the better approach due to the anatomical features from the upper molars. The tooth extraction can be an alternative for its cases, but a rehabilitation with implants is necessary, and sometimes, this treatment can be expensive, especially when other surgeries are needed, for example, the maxillary sinus lift associated with the bone graft. Then, the patient will receive the treatment with several surgical steps; spending time and enhancing the costs until the rehabilitation will be achieved. Furthermore, the same care related to oral hygiene should be maintained due the susceptible of peri-implantitis development.\[8\]

The principle approach of this case series focused on resective procedures, especially in root amputation. Although the degree Grade III furcation can be the worst prognosis, teeth with furcation can be maintained for many years under healthy conditions when treated appropriately. The resective treatments of furcation lesions aim to improve or eliminate inflammation, creating a favorable environment for plaque control and repairing the periodontal tissues.\[9\] In cases of degree Grade III furcation involvement, root amputation may be a viable approach for the long-term maintenance of the dental element. Nevertheless, the success of this therapy depends on several factors, such as supportive periodontal therapy (SPT) and anatomical aspects related to the defect.\[9,10\]

Despite the widespread use of dental implants and the high success rate of this therapy in the long term, the patient’s desire to preserve their natural dentition is constantly increasing. Choosing the proper treatment can be the maintenance of Grade III furcation teeth or a dental extraction with the rehabilitation with implants requires an accurate planning that involves the knowledge and practice by the dentist as well as the expectations and compliance by the patient.

In this way, 13 clinical cases of root amputation with the treatment of degree Grade III furcation lesions in maxillary molars with 16 years of follow-up are presented. Factors related to the success and failure of this approach are discussed.

**CASE REPORT**

The data of this study were collected in archives of a dentistry clinic between the years 2000 and 2018. This case series is composed of 10 patients (5 men/5 women), totaling 13 upper molars treated by the same operator during those years. At the end of surgery periodontal therapy, all patients were kept under SPT. The archives contained the following data: demographic data (age, gender, and educational status), disease diagnosis, probing depth (PD), bleeding on probing (BOP), and periapical radiographs. Patients were systemically healthy, nonsmokers and had a diagnosis of localized or generalized and moderate or advanced chronic periodontitis (AAP, 1999) with degree Grade III furcation involvement.\[1\] Demographic data are shown in Table 1, and the initial and final clinical parameters are shown in Table 2. After diagnose and proper oral hygiene orientation, the nonsurgical periodontal therapy was performed. The plaque and bleeding indexes were determined again, and an appropriate surgery therapy was performed. All the surgeries were performed by an expert in periodontics. To access the root area, a total thickness flap was made; the selected root for amputation was sectioned by means of high-speed drills, and the low-speed drill was used to remove possible steps. Achieving the ideal regularity and shape must be done to create a favorable environment for the patient’s hygiene. Then, the flaps were sutured. An anti-inflammatory and an antibiotic were prescribed as preoperative medication, and in case of pain, analgesics too. Furthermore, the mouthwash with chlorhexidine digluconate 0.12% was prescribed each 12 h for 14 days. The sutures were removed after 7 days of the procedure.

The patients were included in a periodic maintenance program with visits every 3 months or according to each patient’s condition and were referred for restorative treatment. Two clinical cases with follow-up of 2 years [Figures 1 and 2] and one clinical case with 16 years [Figures 3 and 4] are presented with steps of resective procedures and prosthetic treatment.

In all cases, PD and BOP were reduced; however, especially when we had deep pockets, residual pocket appeared as a result of treatment. Despite it, they had a good result after the therapy comparing the initial clinical parameters to follow-up. Furthermore, the patients are remaining in SPT and all teeth are in function after the treatment. The SPT is an important step because deep residual pockets and bleeding on probing [Table 2] have a value predictive of attachment loss at long term and these sites should be monitored over the years, and other interventions can be performed when required.

**DISCUSSION**

This case series showed the treatment of degree Grade III furcation involvement in upper molars with a follow-up between 2 and 16 years. Molars with degree Grade III furcation involvement can be preserved by an adequate resective treatment or can be replaced by implants. The maxillary molars are the most commonly lost teeth, followed by the lower molars. Having a greater significant risk of loss than mandibular molars\[8,9,10\] and the prevalence of furcation involvement in the upper molars (25%–72%) is higher than the inferior ones (16%–50%).\[9\] In addition, the maxillary molars often present more advanced bone loss than the lower molars. It can be explained by factors that affect dental survival, such as the great difficulty in accessing the furcation area,\[11\] the specific anatomy of the maxillary molars presenting three furcation entrances, as well as the different bone density in the maxilla in comparison with the lower jaw. Some of the factors that could guide the decision to maintain or extract teeth with furcation are mobility, position in the arch, lack of occlusal antagonism, degree of furcation involvement and remaining bone support.\[9\] Deciding by teeth maintenance, the procedures for treatment could be the furcation plasty (odontoplasty), the debridement with surgical access, and the tunneling and radicular resection, according to the degree of furcation involvement.\[9\]

Root amputation can restore an ideal anatomy that allows biofilm removal by the patient and avoids the difficulties

| Table 1: Patient demographic data |
|---------------------------------|
| Patient | Gender | Age (years) | Scholarity (years) |
|---------|--------|-------------|-------------------|
|         | Male   | Female      | Male             | Female          |
|         | 10     | 5           | 5                | 47.8±1.33       | 51.2±8.33       |
|         | 5      | 10          | 16±3.58          | 13.6±1.96       |
of debridement by scaling and root planning in furcation areas. Moreover, the treatment of II/Grade III furcation lesions seems to be less expensive than its removal and implant placement, but the treatment decision must never be guided by just the cost-effectiveness. In addition, patients with systemic diseases may benefit from tooth maintenance, avoiding multiple surgical procedures such as bone grafts and maxillary sinus lift, often performed prior to implant placement.

Resective treatment, despite being a highly complex procedure, can alter the prognosis of the dental element, increasing its survival. In resection studies, including hemisection and root amputation, dental survival differs among studies and depends on the operator, technique, patient, and local factors. The most frequent complications for tooth loss during the years after resective therapy are the vertical root fractures and endodontic failures.

The study by Salvi et al. has shown that the level of horizontal attachment loss is determinant for prognosis since teeth with II/Grade III furcation involvement are more likely to be lost than degree I. After 10 years of follow-up, Carnevale et al. found that the survival rate of treated furcation molars was 93% compared to the molars without furcation. Therefore, a positive result can be achieved with conservative therapy such as root resection.
However, it is important to keep in mind and be aware that just the resective procedure is not enough to achieve good results and an appropriate plaque control is paramount to the successful case, since in a population that does not undergo SPT, the relative incidence of dental loss for degree II/Grade III furcation cases may reach 95% when compared to nonfurcated teeth.\textsuperscript{14,15}

The clinicians are often confronted with this question “What’s the ideal treatment approach to Grade III furcation molar; the resective procedure or implant replacement?” because of the high success rates of implant therapy and more accessibility to this therapy among the population over the years.

This dilemma should be solved based on scientific evidence that analyzes the success rate of both the techniques. Graetz et al.\textsuperscript{9} noticed a 75% success rate to resective therapy, whereas unsuccessful factors can be the upper teeth, the degree Grade III furcation lesion, the endodontic involvement, and the extensive mobility and age. A systematic review\textsuperscript{9,17} revealed that the survival rate varied between 57.9% and 100% during the observation period of 5–10 years and a comparison between the success rates of radicular resection and implants placed in the molar region for up to 15 years, concluded that both techniques, when properly restored, present a high degree of success in function.\textsuperscript{16} However, the failure rate of the root resection is 15.9% compared to 3.6% for implants concluding that root resection therapy shows long-term unfavorable results and underscored the need for a high level of expertise in all disciplines involved in this technique (periodontics, endodontics, and prosthesis). In addition, it has been suggested that surgical and restorative procedures related to implant therapy may be less complex than root resection. Furthermore, the patient’s systemic condition must be considered.\textsuperscript{17}

In another view, the diagnosis of periodontitis and patient’s history of periodontal disease are associated with peri-implantitis,\textsuperscript{18} showing an unfavorable factor for implant placement since the risk for development of this disease seems bigger in these cases. Patients with a history of chronic periodontitis may exhibit long-term pocket depth, marginal bone loss, and incidence of peri-implantitis compared to periodontally healthy individuals.\textsuperscript{13} The literature shows favorable and unfavorable results for both the therapies.\textsuperscript{9,17}

Finally, even with degree Grade III furcation, every effort should be done for the maintenance of teeth when possible.\textsuperscript{13} All these mentioned aspects need to be in mind and be evaluated to guide the ideal approach for each patient. When SPT is properly performed after root amputation, upper molars can be maintained for a long period of time, as we showed. The clinicians are responsible to think critically not only in what treatment approach will be better but also what will be healthier for the patient. In conclusion, even Grade III furcation involvement in the upper molar has a greater risk of dental loss, root amputation is a practicable solution changing tooth prognosis and favoring its maintenance a long term, especially when the patient’s local, systemic, or financial conditions make it difficult or impossible to implant placement.

Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent forms. In the form, the patients have given their consent for their images and other clinical information to be reported in the journal. The patients understand that their names and initials will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

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Conflicts of interest

There are no conflicts of interest.

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