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Root resection therapy in the treatment of advanced furcation involvement

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Abstract

The furcation involvement (FI) is a challenging complication of advanced periodontitis or endoperiodontal lesion that may occur in multi-root teeth mainly in the molar areas. Managing this lesion is a challenging situation for the practitioner given the complex anatomy of the furcation area, especially with the advanced form. Indeed, advanced FI (degree II and III FI according to Hamp's classification) presents frequently a questionable or hopeless prognosis. Many therapeutic procedures, with variable outcomes, including non-surgical, surgical, and regenerative treatment have been suggested to treat these lesions. Resective therapy, such as crown and/or root amputation, root resection, root separation, and tunneling technique, may still be indicated to save a tooth presenting an advanced FI; even if it causes some tissue mutilation. The present article aims to provide, through a case report, the advantages of root resection therapy for the management of advanced FI teeth, and discuss its limitations with regard to periodontal status and root surface quality.

Keywords: Root resection, advanced furcation involvement, molar area.

Introduction

The furcation involvement (FI) term referred to the pathological invasion of the bifurcation and trifurcation area of multi-rooted teeth resulting from periodontitis progression **[1]**. The American Academy of Periodontology (AAP) (1992) defined the lesion as "the pathologic resorption of bone in the anatomic area of a multi-rooted tooth where the roots diverge" **[2]**. Several classification systems were described based on the extension of the defect, the anatomy of the furcation, the

number of remaining bony walls, the morphology of the existing bone, and the relationship between root trunk and vertical/horizontal attachment loss **[3]**. Based on Hamp's classification, three horizontal attachment loss degrees were defined and described as follows **[4]**: class I where horizontal attachment loss is < 3 mm, class II with horizontal attachment loss > 3mm but not encompassing the total width of the furcation area, and class III where an horizontal "through-and-through" destruction of the periodontal tissue in the furcation area is present. Lately, Tarnow and Fletcher introduced a vertical sub-classification of FI as a supplement for better description of the horizontal description. The subclasses were then as follows: **[5]**: subclass A: vertical bone loss ≤ 3 mm, subclass B: vertical bone loss from 4 up to 6 mm, and subclass C: vertical bone loss ≥ 7 mm.

In molar areas, the periodontitis severity and associated tooth loss are more prevalent and could be explained by the complexity of the furcation area anatomy that leads to the rapid development of FI lesions, which creates a critical condition to reach a proper self-controlled plaque control as well as a professional plaque control **[6]**.

Diverse aetiologic factors are commonly involved in the FI initiation and progression. It include, the primary factor related to the bacterial biofilm as the principal aetiology, the predisposing factors e.g. length of root trunk, inter-radicular dimension, location of the furcation entrance, width of buccal and lingual radicular bone, enamel projections, and the contributing factors e.g. occlusal trauma, pulpopathy, vertical root fractures, and iatrogenic factors **[7]**.

The conservative, regenerative, and resective treatment approaches are variously available for FI management. The root resection is a commonly indicated procedure that establishes favourable anatomy of affected surfaces, which facilitates the proper self-performed and professional plaque control **[7]** and reduces the tooth loss risk, particularly in class II and III FI cases. The resection procedure is also indicated in cases presenting a severe bone loss, severe recession, or dehiscence affecting one or more roots when regenerative therapy is not indicated **[8]**.

The present case report aims to discuss the possible therapeutic approaches for FI, and the place of the root resection therapy for the management of advanced FI lesion.

Case Report

A 30-years-old female without any particular health condition was referred to the clinical department of periodontology at the hospital for dental consultations and treatments in Rabat. Her chief complaint was the presence of purulent swelling next the tooth 16.

The clinical examination showed purulent swelling next to the non-carious first upper molar (16) **(Figure 1. a)**. Periodontal probing showed a 10 mm deep periodontal pocket in root furcation area, with a class III buccal/mesio-palatal FI lesion accordingly to the Hamp's classification **[4]**, and a score 2 of dental mobility (corresponding to no greater than 1 mm in a bucco-lingual direction according to Miller index classification) **[9]**. The pulp sensitivity test was negative, revealing the pulp necrosis. The intraoral peri-apical radiographs confirm the presence of bone loss with an evident severe bone loss crater-like surrounding the mesio-buccal root of tooth 16 **(Figure 1. b)**.

Besides this site, periodontal examination showed periodontitis at stage III grade C with molar-incisor pattern, according to the 2017 classification of periodontal and peri-implant diseases and conditions, and previously called aggressive periodontitis (1999 periodontitis classification) **[10]**. Additionally, and with regard the clinical and radiographic data, an endo-periodontal lesion grade 3 was diagnosed in a patient with periodontitis

(corresponding to a wide deep periodontal pocket in more than one tooth surface, based on Herrera et al. classification) **[11]**. The treatment planning consisted of drainage of purulent exudates by scaling and Root planning through the periodontal pocket followed by the endodontic treatment. Meanwhile a periodontal non-surgical treatment was also performed to treat the periodontitis. After three months, a periodontal re-evaluation revealed the improvement of the periodontal parameters except for tooth 16; where a 10 mm pocket depth remained associated with advanced recession. So, we were faced the following situation: the persistence of a large deep pocket, class III FI that made plaque control at this location more difficult, the gingival Recession Type 3(RT3) **[12]**, and absence of attached gingiva. Thus, with the agreement of the patient we achieve a root resection to manage the FI **(Figure 2)**. After local anaesthesia, a full-thickness flap was raised only on the buccal side of tooth 16 and we performed a manual and ultrasonic periodontal debridement. Afterwards, the morphology and the amount of remaining bone defects were evaluated **(Figure 2. a)**. An adequate amount of bone was observed around the disto-buccal and palatal roots; whereas the mesial root was surrounded by a deep and large bone crater. The root resection was then performed **(Figure 2. a, b)**, and the granulation tissue was curetted out of the mesio-buccal socket. Tight O sutures were realized and post-operative radiography was taken **(Figure 2. c)**. The tooth status was reviewed during the following months, and at one-year of the follow-up. The clinical assessment showed a reduction in a periodontal pocket, and absence of gingival bleeding, but no change in mobility degree. X-Rays showed periodontal bone stability **(Figure 3)**. The patient was compliant with the periodontal maintenance program.

Discussion

The present case report, described the management of a FI lesion as a complication of advanced periodontitis. Advanced FI is a frequent pathological form of affected furcation areas that requires well-defined treatment planning for the management and for the survival extending of a multiroots teeth. Some studies report that the prevalence of molar displaying the degree II and III of FI was less than 9% **[12, 13]**. Another study showed that FI was more prevalent in maxillary molars than in mandibular molars, with a higher percentage for advanced FI of degree II (41.8%), followed by degree I (36.2%), and degree III (18.8%). In addition, distal furcation of the maxillary first molar has a higher frequency rate of FI (53%) **[13]**.

The root resection therapy can be the option treatment for advanced FI to provide a long-term favourable prognosis and tooth survival **[6, 14]**. Periodontal features including severe bone loss affecting a root, severe recession, or dehiscence of the affected root, and the unfavourable root proximity between adjacent teeth, are the main indication for this choice in moderate or advanced FI **[8]**. The periodontal features associated with FI seem to be the most frequent indication of root resection therapy comparing to endodontic and prosthetic reasons, as reported by El Sayed et al. (80, 8%) **[15]**. In the current case report, the root resection was indicated as a result of advanced FI (FI degree III in the buccal/ mesio-palatal), associated with severe bone loss, and endo-periodontal lesion in the context of periodontitis stage III Grade C molar-incisor pattern.

In advanced FI, the non-surgical periodontal therapy provides generally poor results, as well as the direct access to the root surface by surgical debridement **[6]**. Additionally, several studies showed limited evidence of the regenerative therapeutic approaches success for

advanced FI **[16, 17]**. Some studies reported that the effect of guided tissue regeneration (GTR) therapy at furcation sites was less successful in maxillary molars **[18, 19, 20]**. The morphology of the furcation area is a favourable environment for biofilm development, that limits the professional and self-accessibility for a good plaque control, and which compromise the tooth prognosis. Therefore, morphological modifications resulting from the root resection could positively affect the plaque control, and makes this procedure a last conservative option in cases with advanced IF.

The root resection appears to be more convenient for FI maxillary molars, either during conventional or advanced periodontal therapeutic approaches. Indeed, a retrospective cohort study report that 65.9% of root resection in molars were located in the maxilla and which displayed degree II (34.1%), or III (54.5%) FI **[21]**. The upper first molars were the common resected teeth compared to other molars types **[14]**. This is explained by the related-teeth factors, especially in maxillary molars. Indeed, the location of two entrances in proximal sites in maxillary molars is associated with the highest frequency of plaque-associated retention that limits the self and professional control **[13]**. Also, the substantially reduced inter-furcal bone high is often observed at the maxillary molars with advanced FI **[22]**.

The prognosis related to root resection was largely documented, too. However, studies showed a large disparity of the results. Bühler et al. reported that during the 10 years of follow-up, a total of 9 teeth (32.1%) were lost principally because of endodontic complications **[23]**. Lee et al. showed that 44.9% of teeth were extracted just after 3 years of the root resection procedure, and 89 molars (59.7%) were extracted in 10 years of supportive periodontal therapy (SPT) **[14]**. A 10 years follow-up study reported that 38.6% of resected molars were extracted **[21]**. The Derks et al. reported that the global cumulative survived rate of resected molars was 90.6 % after 10 years, which decreased to 34.9 % after 25 to 30 years **[24]**. In a recent systematic review, the survival rate 77% by comparing the non-surgical treatment of class II FI (72%-82%), as well as the open flap debridement of class II (70%-93%) and III (50%-75%) FI, was similar to the overall survival rate of resective procedures (root amputation or resection, and root separation) in class II (44%-86%) and III (35%-79%) FI **[16]**. This heterogeneity in results is related to a lack of studies' data regarding the case selection. Indeed, some factors can influence the resection therapy outcome, such as the patient age, the pre-operative bone level of the affected root(s), the pre-treatment mobility, the plaque control, the SPT compliance, the occlusal factors, the coronal protection, the tooth splinting, the endodontic treatment quality, smoking, and the socioeconomic status **[6, 14-17]**. In the present case, the maxillary molar **[25]** had an intact palatal bone, score 2 as baseline mobility according to Miller's classification **[9]** that decreased to score 1 after the root resection, and the inflammation reduction. The plaque control and the adherence to SPT were ensured by the young non-smoking patient, which guaranteed a more favourable therapeutic prognosis.

Several studies report that most extracted teeth after root resection procedure were due to other complications than periodontal complications **[23, 26-28]**. In the recent decade, with the large survival rates variability of root resection therapy, the involved complications of the procedure, and the introduction of osseointegrated implants in 1982 by Brånemark and Zarb, the recourse to dental implants has significantly increased as a new alternative modality to replace lost teeth **[17, 24]**. The survival rate of implants could influence the dental implant decision, instead of the classical resection surgery.

A recent systematic review and meta-analysis had reported that immediate implants in the molar region had a 96.6% mean survival rate, and 93.3% success rate **[29]**. However, the fast transition between the resection procedures to dental implant placement is not always safe from the increasing of long-term biological and technical dental implant complications unpredictable to be stopped. Simonis et al. concluded that implant complications are frequent, even with a relatively high long-term survival rate. The complications are greater in patients presenting a history of periodontitis by a susceptibility to develop peri-implant mucositis and peri-implantitis **[30]**. According to a systematic review, the prevalence of the peri-implant mucositis ranged from 19 to 65%, while the peri-implantitis ranged from 1 to 47% **[31]**. Moreover, another systemic review and meta-analysis report the possibility to recommend the dental implant placement in patients successfully treated for periodontitis, even though the increased rates of biological complications that might be expected in patients with a history of aggressive periodontitis. It also concludes a statistically significant lower 3-year survival rate (97.98 %), as well as, the great risk of marginal bone loss in one and three years after implant loading in a patient with aggressive periodontitis compared to periodontal healthy subjects and patients with a history of chronic periodontitis **[32]**. Therefore, some FI cases could still be treated safely by root resection therapy and avoid the additional time and cost required to the supplement and complex surgery such as bone augmentation procedures. Nevertheless, it’s crucial to ensure an inflammation-free periodontal environment of maintained molars with advanced FI to prevent further bone loss that compromises potential future implant placement. According to Avila et al. in case of the furcation involvement class II and class III FI (Hamp et al. classification), the final decision to maintain a tooth, depend on interproximal bone level of furcation entrance which if reduced should be still favourable to tooth retention, the absence of root anomalies, and no concern regarding the root resection cos.**[33]**

Conclusion

The root resection therapy is considered as the last conservative decision justified for molars with advanced FI. The procedure could be a good indication in younger and healthy patients like those suffering from incisor-molar pattern periodontitis. Initially, this situation revealed a strong tendency to lose molars; but once treated it's easier to be maintained. At last, the adequate treatment planning answering to patient's expectations should consider the importance of conventional conservative therapy as a root resection procedure; instead of instantly indicate the radical approaches as dental implant therapy.

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Legend Figures

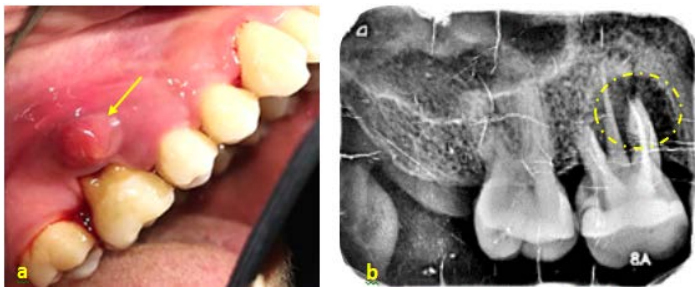

Figure 1: Initial situation; a. clinical view of purulent swelling next to the non-carious first upper molar (16), b.

radiographic view of the severe bone loss (crater bone) surrounding the mesio-buccal root.

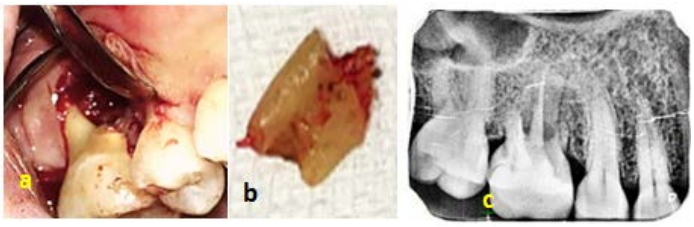

Figure 2: Root resection procedure; a. full-thickness flaps and root resection of mesio-buccal root in first upper molar (16), b. the portion of mesio-buccal resected root, c. immediate post-operative radiography

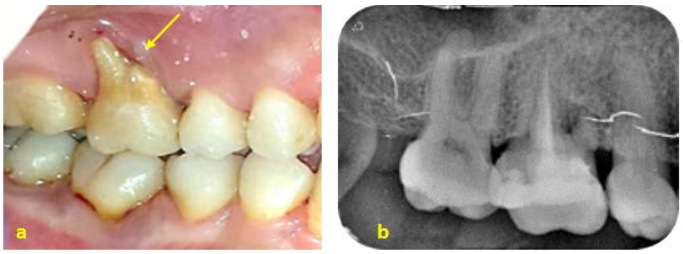

Figure 3: Periodontal maintenance (after 1 year); a. clinical assessment of the first upper resected molar (16), b. radiographic assessment of the bone level