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Complications of Root Amputation: A Case Report

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Introduction

Root amputation is the removal of a root from a multi-rooted tooth. It is a technique for maintaining the tooth with an attachment loss in the furcation or endodontic failure. Several authors have listed the following indications and limitations of the root resection therapy.¹⁻⁴ The acceptable indications from the periodontal points are severe vertical bone loss affecting one or more roots untreatable with regenerative procedures, class II or III furcation invasions or involvements, severe recession or dehiscence of a root, unfavorable proximity of roots of adjacent teeth, preventing adequate hygiene maintenance in proximal areas and severe root exposure due to dehiscence. Endodontic or conservative indications are inability to successfully treat and fill a canal, root fracture or root perforation, severe root resorption, root decay, and vertical fracture of one root. Prosthetic indications are severe root proximity inadequate for a proper embrasure space, root trunk fracture or decay with invasion of the biological width and prosthetic failure of abutments within a splint. While root resection therapy would be contra-indicated if the patient has systemic factors, poor oral hygiene, fused roots of the tooth, unfavorable tissue architecture, retained endodontically untreatable roots, excessive endodontic instrumentation of retained roots or excessive deepening of pulp chamber floor. In addition, other factors that should be considered include the availability of the adjacent teeth for conventional prosthetic restoration or the removable prosthesis or implants.

Success of root amputation procedure depends, to a large extent, on a proper case selection. The morphology of the multi-rooted tooth is important for the treatment of furcation. The morphology factors such as clinical length and shape of the root, including the root trunk length and furcation entrance should also be considered.⁵⁻⁶ The teeth with long root trunks and short roots may not be strong because of the inadequate bone support. While the furcation entrance can affect an accessibility of instrumentation, teeth with divergent roots are easier to be resected. On the other hand, closely approximated or fused roots are not the good candidates to receive hemisection therapy.⁶⁻⁷ The prognosis for the root amputation depends on the appropriate case selection and the acceptable design of the restoration related to the occlusal and periodontal needs of the patient. Various studies have evaluated the effectiveness and prognosis of root resection in multi-rooted teeth. Most of the authors used the tooth survival as the only evaluation criterion for long-term results. The 10-year longitudinal study of Carnevale was designed to evaluate the long-term effect of root resective therapy in the treatment of furcation-involved molars. The results of the assessments demonstrated that the survival rate reached to 93% during the 10-year period of observation.⁸ The study of Langer et al., in order to evaluate the long term results of root resection, showed that only 15.8% of the failure occurred within the first 5 years after surgery, whereas between the 5th and 7th years, 55.3% of all failures occurred. There was approximately a 2:1 ratio of mandibular to maxillary failures.⁹ Klavan evaluated the single root amputation of maxillary molars. A total of 34 maxillary molar teeth were studied in 29 patients. The observation period ranged from 11 to 84 months, with a mean duration period of just over 3 years post-operatively. All of the teeth were in function, and 24 were nonsplinted individual units. Over the study period, only 1 tooth was extracted, none increased in periodontal pocket depth, and 3 showed increased mobility.¹⁰ The keys to long term success of root resection therapy appeared to be the thorough diagnosis, selection of patients with good oral hygiene and careful multidisciplinary approach including periodontal surgery, endodontic treatment, and restorative management.¹¹ Root separation has received acceptance as a conservative and dependable dental treatment and teeth so treated have endured the demands of function.¹²

Case Report

A 42-year-old female patient presented with a complaint of persistent throbbing pain at the left maxillary first molar (26) with composite filling. The patient had root canal treatment of the 26 2 years ago. Two to three months after the treatment, the patient developed a pain therefore the upper molar with endodontically complicated mesiobuccal (MB) root canal was managed using root amputation therapy. However, it revealed that the gingiva could not be closed. The intraoral periapical radiograph demonstrated the residual spicule of the MB root (Figure 1). Therefore the patient was treated by the second surgery in order to remove the residual spicule of the MB root. One year after the surgery, the patient complained of the same symptoms including the throbbing pain at 26. Finally she was referred to our hospital for further management.



Figure 1 The radiograph shows the residual spicule of the MB root after the first time of root amputation

On intraoral examination, the overall gingival health appeared normal. However, the 26 area was slightly red with a round margin. The interdental papillae were blunt, soft in consistency gingiva, keratinized 1 mm, and bleeding on probing. Overall the periodontal status was good except for the 7 mm. pocket presenting on the mesiobuccal of the 26. There was grade I mobility (Figures 2 and 3). The tooth was positive to percussion. The opposite teeth were bridge and the 26 was slightly under occlusion.



Figure 2 The picture shows gingiva at the buccal side



Figure 3 The picture shows gingiva of the 26 at the palatal side

On radiographic examination, the 26 was root canal treated with composite filling. Vertical bone loss of the mesiobuccal aspect of the 26 was evident involving the furcation area and there was widening of the periodontoligamental space (PDL) at the apical 1/3 of the palatal root. Besides, there was a residual spicule of the mesiobuccal root (Figure 4). Based on the clinical and radiographic findings, this case was diagnosed with localized chronic periodontitis on the 26.



Figure 4 The radiograph shows the vertical bone loss, the thickening of the PDL at the 26 and the residual spicule of the MB root

Surgery procedures

Under a local anesthesia, an intrasulcular incision was done and extended from mesial 24 to distal 27, on both buccal and palatal aspects. Full thickness flap was reflected till the base of intrabony defect. After a complete reflection, the thorough debridement was done at the defect area using Gracey's curette #13 and #14. Scaling and root planing were carried out on the exposed root surface area of the defect. At the 26, there was a residual spicule of the mesiobuccal root and the hemisepta bony defect was 2-3 mm deep, near the distobuccal root and the palatal root (Figures 5. and 6.).



Figure 5 Full thickness flap from mesial 24 to distal 27



Figure 6 The residual spicule of the mesiobuccal root. The hemisepta bony defect was 2-3 mm deep near the distobuccal root and the palatal root.

A correction by 25-27 osteotomy at the buccal bone of 25, 1-3 mm. and an osteoplasty were done to reduce the thick bony ledge. An interradicular groove and a rampling bone were made to improve the positive architecture. The furcation area was corrected to ensure that no residual spicule was presented to cause further periodontal irritation (Figures 7 and 8).



Figure 7 Osteotomy and osteoplasty to improve positive architecture at the buccal side



Figure 8 Opening flap debridement at the palatal side

Apically positioned flap was done by suturing with continuous sling suture with 3/0 black silk sutures (Figures 9 and 10). The pressure pack flap was performed for 10 minutes approximately. Periodontal dressing with Coe-Pak® was placed over the surgical area. Post-operative instructions and medications (Amoxicillin 500 mg. 1x3 pc 20 capsules, Ibuprofen 400 mg. 1x3 pc 15 tablets.) were given to the patient. In addition, the patient was prescribed 0.12% chlorhexidine mouthwash for rinsing twice daily.



Figure 9 Apically positioned flap with continuous sling suture at the buccal side



Figure 10 Apically positioned flap with continuous sling suture at the palatal side

Seven days post-surgery, the dressing was removed. Continuous sling suture was stitched off. There was no infection but a little inflammation at the mesial aspect of 26.

One month later, the 26 had 4 mm. pocket depth, bleeding on probing, and no throbbing pain. A rescaling and a root planing were done.

Three months later, the overall gingiva health appeared normal. The 25-27 gingiva was pale pink in colour with a round margin. The interdental papillae were blunt, firm in consistency, bleeding on probing at mesial and distal aspect of the 26. The pocket depth at the mesial of the 26 was 4 mm. on both buccal and lingual aspects (Figures 11. and 12.). On radiographic examination, there was no thickening of PDLs (Figure 13.). The rescaling and the root planing were done. The restoration was done with a composite filling. The opposite tooth was pontic of bridge and there was a slightly contact with the 26. Moreover, the final restoration should be crown and reduced occlusal table in order to reduce the occlusal force.



Figure 11 3 months post-surgery at the buccal side



Figure 12 3 months post-surgery at the lingual side



Figure 13 The radiograph shows the absence of the thickening of PDLs after 3 months

Discussion

Root amputation remains a clinically critical procedure in order to achieve a high success rate of treatment in the furcation-involved teeth and to restore the teeth's health and function. However, there are a number of disadvantages associated with this procedure. Like other surgical procedures, the root amputation can cause pain and anxiety. Root surfaces that are reshaped by grinding in the furcation or at the site of root separation are more susceptible to caries. Failure of endodontic therapy due to any reasons can cause failure of the procedure. In addition, when the tooth has lost some parts of its root support, it requires a restoration to permit it to function independently or to serve as an abutment for a splint or bridge. Unfortunately, a restoration can contribute to periodontal destruction, if the margins are defective or if non-occlusal surfaces do not have physiologic form.¹³⁻¹⁴ However the maxillary molars did not succumb to occlusal forces as readily as mandibular molars for several reasons. First, most maxillary molars have at least two roots remaining after resection, one of which is usually a large palatal root which helps the tooth to withstand occlusal forces. This larger one is definitely less susceptible to root fracture than the smaller root of mandibular molars.⁹

Case selection for root resection therapy should take into consideration as well as the skill and expertise of the clinicians.^{8,15} In this reporting case, the patient was treated by surgery 3 times because of the endodontic failure with no bone loss therefore it was difficult to perform the root amputation in this patient. Root resection to treat periodontal problems showed a better prognosis than the root resection being performed for non-periodontal problems (tooth fracture, dental caries, and endodontic problems).¹⁶ To achieve good results in periodontally diseased molars, >50% bone support of the remaining roots at the time of the root resection is an important factor. Periodontal problems around resected molars have a tendency to recur and should be maintained through meticulous supportive periodontal treatment.¹⁶

The study of Langer et al. in order to evaluate the outcome of root resections being performed in the 10-year period showed that only 15.8% of the failure events occurred within the first 5 years after surgery. Only 26.3% of failures resulted from progressive periodontal breakdown and most of those were maxillary molars.⁹ Failure of these teeth was related to the recurrence of pocket depth and the development of the additional bone loss in the remaining furcations. In this case being reported, the residual spicule of the amputated root could not be completely removed resulting in a further periodontal irritation. The possible complications which may occur during the root resection procedures are subluxation of the adjacent teeth, injury of the interradicular or proximal bone with the bur, notching of the remaining root with the bur, or the retaining of the furcation after the root removal. Osseous resection surgery is also required following the root removal. Backman described 4 cases of improper or incomplete root resections. He observed the continued loss of osseous structure following the amputation.¹⁷ Newell¹⁸ examined 70 root-resected teeth and found that the subgingival residual root spur or lips and ledge could be left up to 30%. The study of Carnevale⁸ demonstrated that the survival rate, during the 10-year period of observation, reached 93%. The positive treatment outcome was probably the consequence of the reestablishment of a tissue morphology favorable for oral hygiene and careful plaque control by the patients. Thus after sectioning of the root, the osseous resective surgery should be performed to eliminate the angular bony defects and to reduce the buccolingual dimension of the alveolar process for re-establishing of the normal bone architecture.

Even though the dental implant can be one of the alternative ways of substitution a furcation involved tooth, the 1989 World Workshop in Periodontics recommended that the root resection therapy was

a procedure which should be maintained as a part of the periodontal armamentarium to treat very specific problems which could not be solved by any other therapeutic approaches.¹⁹

Conclusions

Root amputation is a treatment option for molars with periodontal, endodontic, restorative, or prosthetic problems. Due to the complexity of the technique and the requirement of high surgically reconstructive skill, the root amputation procedure should be performed by the expertized clinicians in the appropriately selected patients.^{1,8,14-15}

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