

REVIEWS

CURRENT APPROACHES TO THE TREATMENT OF TEETH WITH FURCATION DEFECTS

Tsvetalina Gerova-Vatsova¹, Ralitsa Yotsova², Madlen Ali², Yanko Yankov^{3,4}

¹*Department of Periodontology and Dental Implantology, Faculty of Dental Medicine, Medical University of Varna, Bulgaria*

²*Department of Oral Surgery, Faculty of Dental Medicine, Medical University of Varna, Bulgaria*

³*Department of General and Operative Surgery, Faculty of Medicine, Medical University of Varna, Bulgaria*

⁴*Clinic of Maxillofacial Surgery, St. Marina University Hospital, Medical University of Varna, Bulgaria*

ABSTRACT

INTRODUCTION: When the bifurcations and trifurcations of multirrooted teeth are invaded by a periodontal disease process, it is referred to as furcation involvement. The treatment of these defects is extremely complex but determines the prognosis and survival of the teeth with affected furcation.

AIM: The aim of this study is to specify current treatment approaches for different types of furcation defects.

DISCUSSION: Today, we are familiar with the fact that teeth with furcation defects are considered teeth with a doubtful prognosis or non-rational for treatment in periodontal therapy. Because of their morphological features, accessibility, and the complexity of the healing, furcation defects pose a challenge to doctors. Over the years, a variety of studies have been conducted regarding the treatment of teeth with affected furcation. Non-surgical periodontal therapy has repeatedly been shown to lead to unsatisfactory results in these teeth (the exception being isolated cases of teeth with class 1 furcation defects). The reason for this lies in the inability to perform adequate debridement in relation to the anatomy of the furcation. Based on numerous studies and their results, nowadays it is clear that for teeth with a furcation defect (mostly class 2 and less often class 1) the most used methods are those of regenerative therapy. Class 3 furcation defects are the ones where the teeth are indicated for resective surgery or extraction with subsequent implant placement in the area.

CONCLUSION: The presented study shows that presently in class 1 furcation defects, emphasis is placed on non-surgical periodontal therapy. In class 2 furcation defects, particular attention is paid to regenerative treatment methods, and in class 3 furcation defects, if radical actions are chosen, such as tooth extraction and implant placement afterwards, or if there are contraindications for such—there is a compromise option involving specific resective methods.

Address for correspondence:

Tsvetalina Gerova-Vatsova
Faculty of Dental Medicine
Medical University of Varna
84 Tzar Osvoboditel Blvd
9002 Varna, Bulgaria
e-mail: cvetalina21@gmail.com

Keywords: furcation, furcation defects, furcation treatment, periodontal regeneration, periodontology

Received: August 3, 2024

Accepted: September 2, 2024



INTRODUCTION

1. Etiology

When the bifurcations and trifurcations of multirooted teeth are invaded by a periodontal disease process, it is referred to as furcation involvement (1, 2). When the inflammatory process advances and spreads into the bi- or trifurcation, loss of clinical attachment level and of bone in the area occurs as a result of the invasion of microorganisms (1, 3). The main factor that induces the formation of the furcation defect is the retention of bacterial plaque in the area and the inflammatory reaction of the macroorganism induced by it (1). However, there are some local features that can lead to the accumulation of this bacterial biofilm, such as pulpal periodontal disease (due to multiple open extra canals in the furcation area) (3), trauma from occlusion (3), iatrogenic factors (defective restorations adjacent to the furcation, endodontic perforations) (4, 5), root fractures involving furcations (1, 3), or local anatomic factors (root trunk length, cervical enamel projections, enamel pearl, interradicular dimensions) (1).

2. Current Classification Systems

Many classification systems exist to describe furcation defects. They are based on the prevalence of the bone defect and the loss of attachment in the furcation area (1, 6).

One of the first classification systems was that of Glickman, published in 1972, which described the main characteristics of furcation defects (7).

In 1975, Hamp, Nyman, and Lindhe (8) published their classification system, which was based on degrees of horizontal attachment loss.

A little later, in 1979, Ramfjord and Ash (9) published a modification of the 1975 classification system of Hamp, Nyman, and Lindhe.

Later, to supplement the horizontal classification, a subclassification was established. It referred to the vertical bone loss from the furcation fornix (10).

The above classification systems are the most commonly used by dentists today (6, 11).

In 2018, Pilloni and Rojas (11) proposed their newest classification system of furcation defects.

3. Diagnosis and Prognosis

Only in cases where attachment loss has taken place in the furcation area may furcation be clinically

detected (1). Different criteria for diagnosis and prognosis of these teeth are presented in the published literature. The diagnosis and characterization of each furcation defect determines the prognosis of the corresponding tooth and the treatment method (1, 3).

Clinically, the most commonly used probes for the determination of furcation defects are those of Nabers: Nabers 1 for the furcations of maxillary teeth and Nabers 2 for the furcations of mandibular teeth (1).

Radiographically, intraoral periapical radiographs, bite-wing radiographs, and orthopantomographs are still used to diagnose furcation defects. However, it is important to clarify that these 2D radiographic examinations are the least effective in diagnosing furcation defects and determining their characteristics due to image superimposition, etc. (12,13,14). That is why today the most reliable radiographic method for detecting and determining the parameters of furcation defects are cone-beam computed tomography (CBCT) examinations (13,14).

Clinical and radiographic evaluation of these defects is of utmost importance as they affect the prognosis and treatment of the teeth involved (1,15).

AIM

The aim of this study is to describe current treatment approaches for different types of furcation defects.

MATERIALS AND METHODS

We examined the Google Scholar and PubMed archives for relevant literature on the subject. Every article under examination was released between 1972 and 2024. The search was conducted using a variety of terms and their combinations, including “furcation”, “furcation defects”, “furcation treatment”, “periodontal regeneration”, “periodontology”.

RESULTS AND DISCUSSION

Today, we are familiar with the fact that teeth with furcation defects are considered teeth with a doubtful prognosis or non-rational for treatment in periodontal therapy. Their survival rate is lower compared to teeth without furcation defects (1,15). Because of their morphological features, accessibility, and the complexity of the healing, furcation defects pose a challenge to doctors (1, 16). Over the years, a

variety of studies have been conducted regarding the treatment of teeth with affected furcation. Non-surgical periodontal therapy has repeatedly been shown to lead to unsatisfactory results in these teeth (the exception being isolated cases of teeth with class 1 furcation defects). The reason for this lies in the inability to perform adequate debridement in relation to the anatomy of the furcation (1, 17, 18, 19). Based on numerous studies and their results, nowadays it is clear that for teeth with a furcation defect (mostly class 2 and less often class 1) the most used methods are those of regenerative therapy (20, 21, 22, 23). In class 3 furcation defects, the teeth are indicated for resective surgery or extraction with subsequent implant placement in the area (1, 23).

In order to address various confounding factors, including the shape and size of the furcation roof, entrance and divergence of the roots together with the alveolar housing, and the varied nature and types of periodontal destruction, the unique anatomy and morphology of the furcation area require a variety of special procedures and modified methods of treatment (24).

1. Furcation Plasty (Osteoplasty, Odontoplasty and Root Planing)

The components of furcation plasty are root planning, osteoplasty, and odontoplasty. In this method the furcation level is worked upon and the idea is to modify the area from plaque-retentive to plaque-non-retentive. The aim of this method is to rebuild the soft tissue architecture and to facilitate the patient's personal oral hygiene in the area (1).

2. Tunnel Preparation

It is a technique that is mainly used for class 3 furcation defects of mandibular molars. The intervention aims to create a tunnel in the furcation area, which can be cleaned by the patient with an interdental brush, thus facilitating oral hygiene in the area. The interradicular bone is removed and the soft tissues are positioned more apically. Postoperatively, regular fluoride application is necessary due to the risk of root caries development. Nowadays, it is rarely done because of the high frequency of problems like root cavities and hypersensitive dentin, and the complexity of post-operative maintenance (1, 3).

Vandersall and Detamore (25) published in 2002 their study in which they performed tunnel

preparation in inferior molars with class 3 furcation defects. The study concluded that tunnel preparation in a properly selected clinical case and a patient motivated to maintain proper personal oral hygiene leads to improved prognosis and survival of the involved tooth.

3. Bicuspidation (Premolarization)

Bicuspidation is the separation of the roots (along with the crown portion of the tooth) of a single multirooted tooth and preservation of all the roots. The division is done in two equal parts. Bicuspidation produces two premolars from one mandibular molar (1).

4. Hemisection

A method in which the roots are separated along with the adjacent crown portion of the tooth and one or two of them are removed. Separation is done according to the size of the roots. This technique is used for class 3 furcation defects of mandibular molars (1, 3, 26).

In 2019, Buragohain (27) published his successful case after hemisection of a mandibular molar, concluding that this method offers an option when patients refuse to have the corresponding tooth extracted.

5. Root Amputation

This method is a modification of hemisection, but is applicable to maxillary molars. One of the roots is separated and extracted, but without the adjacent crown. However, it is of utmost importance not to disturb the statics of the tooth. Usually, either the mediovestibular or the distovestibular root of the maxillary molar is removed (28). The extent of supporting tissue surrounding the roots, anatomical features of the root system and its endodontic and periapical state are all factors to take into account when choosing which root to remove (29).

6. Periodontal Regenerative Procedures

Today, it has been established that the most predictable results of regenerative therapy methods are seen in class 2 furcation defects (1).

Different surgical regeneration methods have been suggested to address periodontitis-related furcation problems in teeth. The most commonly reported of these are bone replacement grafts (autografts, allografts, or xenografts) (BRG), guided tissue

regeneration (GTR) using resorbable or non-resorbable membranes, and combinations of them. Bioactive agents include enamel matrix derivative (EMD), platelet-derived growth factor (PDGF), platelet-rich plasma, platelet-rich fibrin (PRP/PRF), as well as different combinations involving them (18,23,30,31,32).

In 2020, Jepsen et al. (18) published a systematic review that included only randomized clinical trials with a follow-up duration of at least 12 months. The team evaluated the clinical outcomes of regenerative procedures in the treatment of furcation defects compared with open-flap debridement procedures. The results they reached strongly confirm the greater effectiveness of the application of regenerative methods. However, one of their conclusions is that no gold standard can be established at this stage regarding the method of regenerative therapy for class 2 furcation defects.

In 2023, Fukuba et al. (33) clinically investigated the results of periodontal regenerative therapy with carbonate apatite granules in vertical bone defects and class 2 and class 3 furcation defects. The team concluded that cases with vertical bone defects and class 2 furcation defects had greater predictability of outcomes compared with those with class 3 furcation defects.

7. Extraction

Sometimes valiant attempts to rescue teeth implicated in furcation may end up being in vain. Both the specific state of each tooth and the case's overall prognosis need to be thoroughly assessed by the doctor. Poor restorations, root resorption, endodontic lesions, extensive caries, and root caries can all serve as plaque traps and negatively impact a tooth's prognosis (1).

Teeth with furcation abnormalities that are not treatable endodontically, those with considerable bone loss and excessive mobility, and those that cannot be accommodated to a clear treatment plan have to be extracted (3).

CONCLUSION

In conclusion, we can summarize that the furcation defects are important for the prognosis of the tooth and the results of its treatment. From the numerous studies available to date, it is clear that adherence to the principles of treatment of furcation de-

fects produces very good results, which also prove to be durable over time. When deciding on the treatment of furcation defects, it should be known that there is no scientific evidence that any one treatment method is better than the others.

However, we can summarize that presently, in class 1 furcation defects, emphasis is placed on non-surgical periodontal therapy. In class 2 furcation defects, particular attention is paid to regenerative treatment methods, and in class 3 furcation defects, if radical actions are chosen, such as tooth extraction and implant placement afterwards, or if there are contraindications for such—there is a compromise option involving the resective methods described above.

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