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Functional Crown Lengthening: A Pre- Restorative Treatment For Long-Term Survivability

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Abstract

Background: Factor that become biggest challenges to achieve a good restoration result is to increase the height of clinical crown length deficiency in which establish the stability of dentogingival complex to improve retention and obtain an aesthetically pleasing final restoration. Functional crown lengthening is one of the most common surgical procedures performed to achieve result that increase clinical crown length. **Case Report:** In this case report, a 38-year-old female patient who required functional crown lengthening due to a fractured tooth 35 and no clinical crown remaining is discussed. The patient was referred by the prosthodontics department. **Case Management:** The case patient was treated with functional crown lengthening (FCL) with through calculation and consideration. **Discussion**: FCL is a minimally invasive surgical procedure that can prolong the teeth while maintaining healthy periodontal structure. This is known as an interdisciplinary approach in consideration of the biological and anatomical aspects of the tooth that will determine the success of the treatment. **Conclusion:** Goal of FCL is one of the deciding factor for restorative treatment with inadequate clinical crown, to maintain ideal biological width and build-up of the supragingival structure, to achieve a ferrule effect that improve the durability of the restoration.

Keywords: Functional Crown Lengthening; Biological Width; Ferrule Effect

1. Introduction

Functional crown lengthening is one of the most frequently performed surgical procedures. Its objective is to expose or open the surface of the tooth. This is achieved by repositioning the tooth tissue and alveolar bone to a more anterior position.[1] The primary objective of crown lengthening procedures is the restoration of adequate biological width and the creation of sufficient space for the appropriate placement of prosthetic margins. This can be achieved through surgical, orthodontic, or a combination of both approaches. The aim of these procedures is to maintain the biological width associated with periodontal tissue health while ensuring sufficient retention and resistance to support the restoration.[2]

Dental procedures such as root canal retreatment are indicated when the tooth in question has undergone secondary caries, urban fractures or extensive restorations. Root canal retreatment presents a number of unique challenges, including the need for effective isolation; the retrieval of filling material from previous procedures; and the final restoration.[3] The selection of the final restoration material is a crucial element in the efficacy of such procedures. Therefore, the planning for the final restoration should be conducted prior to the beginning of the root canal treatment.[2]

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The most significant considerations in determining the optimal restorative approach are the residual characteristics of the crown and root structures of the tooth in question, along with a detailed evaluation of the compromised tooth reconstruction in relation to the overall value of the tooth within the treatment plan. It is of paramount importance to preserve the intact coronal and radicular tooth structure, particularly the cervical tissue in order to create a favourable ferrule effect, for the purpose of restoring the teeth to their optimal biomechanical behaviour.[4]

The periodontal tissue plays an essential role in dental aesthetics and functionality, acting as a barrier against microorganisms. The failure to consider the biological width in restorative procedures can result in an unfavorable periodontal response. In cases where the tooth structure has been compromised, surgical crown lengthening can effectively restore it. Similarly, a post restoration is essential for root canal-treated teeth with loss of structure to ensure optimal functionality and aesthetics. [5]

In this case, the patient presented with a fractured tooth that had undergone extensive coronal structure loss, resulting in the absence of a clinical crown. In such instances, the treatment of teeth with more than a half section necessitates the utilisation of root canal pegs. The primary function of the post is retention and core retention in teeth that have lost extensive coronal structure. The use of restored crowns made from porcelain has become a common practice in dentistry due to their superior aesthetic qualities compared to other restoration materials. The retreatment procedure is undertaken with the objective of eliminating the root canal obturation material from the initial root canal. This is followed by a series of subsequent steps, which encompass cleaning and shaping, sterilisation, and re-obstruction.[6]

2. Case Report

A 38-year-old female patient presented at the Dental Hospital of the Faculty of Dentistry, University of North Sumatra (RSGM FKG USU) with a chief complaint of difficulty chewing food due to a broken lower left tooth that had occurred one month prior. The patient indicated a preference for retaining the tooth and avoiding extraction, and stated that she was not interested in using a removable denture. The patient had previously utilised a removable denture for a period of ten years, but subsequently found it to be an uncomfortable solution. Furthermore, the patient had previously undergone implant treatment in the areas of teeth 11, 46 and 37 (the upper front right, the back right and the lower left, respectively) and had sustained a fracture to tooth 35 (the lower back left) approximately one month prior to the initial consultation.

The clinical diagnosis is localised gingivitis, which is a consequence of dental biofilm-induced inflammation and is mediated by local risk factors, with the presence of endo-periodontal lesions without root damage. The patient is not afflicted with non- periodontitis and is in Grade 2. The condition is caused by accumulated plaque, which is the primary etiological factor, and is exacerbated by rheumatoid arthritis. Additionally, RB supra and subgingival calculus, caries and inadequate plaque control are present, as are endo-perio lesions.

Radiographic examinations provide evidence of bone sounding and pocketing in the depth of the alveolar bone. The recommended treatment plan for this tooth is as follows: crown lengthening, endodontic retreatment and the placement of a zirconia crown with a fibre post. At the initial appointment, an evaluation was undertaken to ascertain the appropriate functional crown lengthening procedure for tooth 35, with the objective of attaining an adequate biological width and ferrule

The patient was cooperative, the prognosis was favourable due to the absence of systemic disease that could affect the condition of the periodontal tissues, and the patient did not smoker. Previously, the process of checking plaque control was carried out, scaling of the supra and sub gingiva of RA and RB was performed, the response to gingival inflammation, plaque and calculus was evaluated, and patient education was provided.

Subsequently, a crown lengthening procedure was conducted on tooth 35, in addition to an endodontic retreatment on the same tooth. The preceding gutta-percha was removed using a retreatment file (Protaper Universal Retreatment, Dentsply), and the canal was medicated with calcium hydroxide (Ultracal XS, Ultradent). The patient

was prescribed amoxicillin 500 mg tablets, to be taken three times a day, along with mefenamic acid 500 mg tablets, to be taken three times a day, and a minosep gargle.

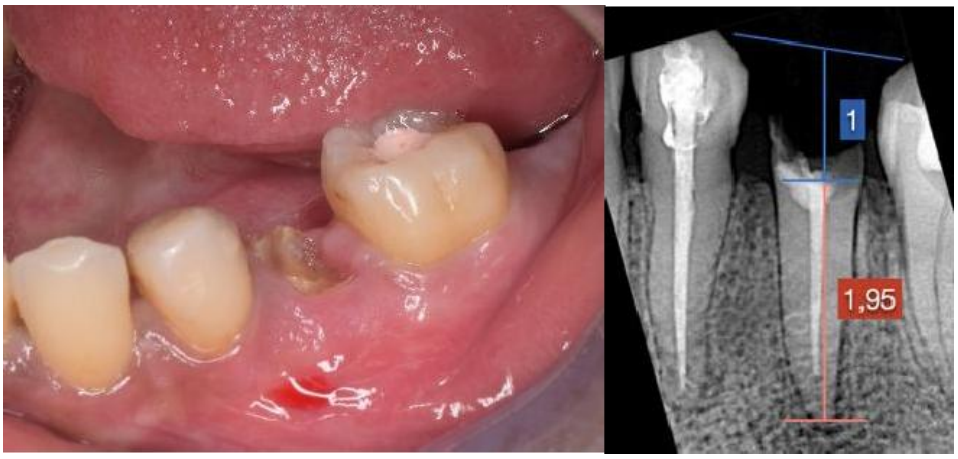

Figure 1. *The clinical and radiographic features of the teeth are presented in this section*

Probing	35
MB	4mm
B	4mm
DB	4mm
MP	3mm
P	3mm
DP	3mm

Bone Sounding	35
MB	5mm
B	5mm
DB	4mm
MP	3mm
P	3mm
DP	4mm

Figure 2. *Probbing and Bone Sounding*

Figure 3. *Treatment Crown Lenghtening and Endodontic Retreatment Procedures*

A follow-up examination was conducted three months after the previous surgical procedure. At this visit, the installation of a zirconia crown was completed, and the patient's response to this procedure was determined through a post-procedural evaluation.

A crown control was conducted 11 days following the placement of the crown. Furthermore, an examination was conducted of the condition of the gingival tissue and the adaptation of the tissue to the crown.

3. Discussion

Crown destruction can be fixed with crown lengthening, which is a common procedure for teeth that have had root canal treatments.[7] Crown lengthening is a suitable option for teeth with subgingival caries or extensive caries that shortens the tooth, as well as for teeth with fractures or short clinical crowns caused by incomplete exposure of the anatomical crown.[8] It is important to consider the biological width of the gingiva, which is the area of attached gingiva between the crown surface and the alveolar bone surface.[5]

The tooth must be at least 5 mm away from the bone to work properly long-term. Also, 3 mm is needed to keep healthy periodontal tissue, and 2 mm should be kept from the incisal coronal structure to the final preparation line. If the top of the tooth is less than 5 mm, it may need to be lengthened. These guidelines are important for getting

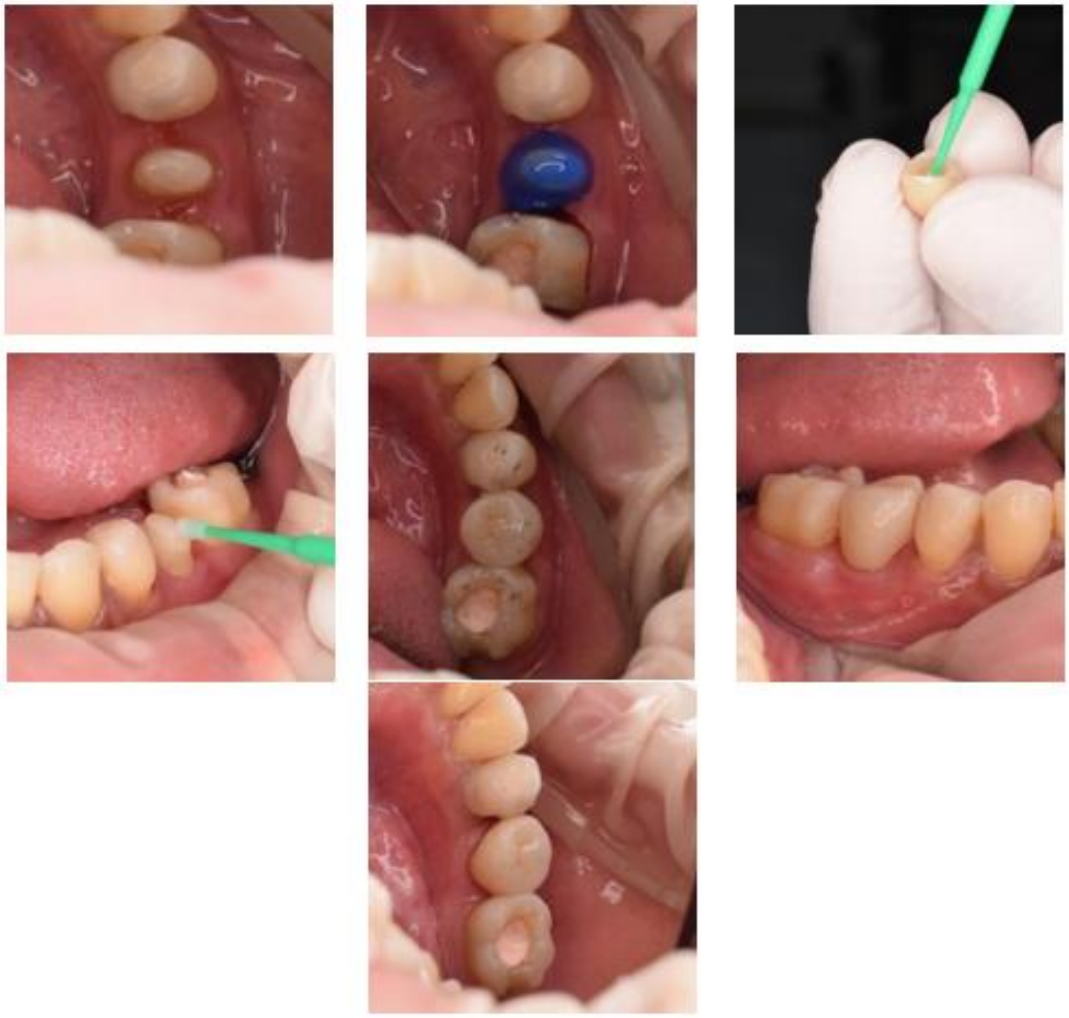

Figure 1 Zirconia Crown, Insertion

Figure 2 *Control Results*

the best results from crown lengthening after endodontic treatment. A crown lengthening procedure should only be done if the crown-to-root ratio is right or the tooth looks good. The tooth gets longer, but the bone supporting it gets

shorter. Such changes may make the tooth less strong. The tooth must have a minimum crown-to-root ratio of 1:1 to withstand lateral forces.[9]

The success of periodontal tissue rehabilitation following root canal treatment is contingent upon a number of factors, with the most significant being the extent of tissue damage and the condition of the tooth prior to treatment.[10] In particular, the prognosis for teeth with a municipal structure and deep subgingival placement is dependent upon the effectiveness of the root canal procedure and the subsequent restoration, as these factors have the greatest impact on the long-term prognosis of the tooth.[3] The restoration edges that approximate or exceed the subgingival depth have the potential to precipitate inflammatory processes in the gingiva, the formation of periodontal pockets, and alveolar bone stress. This is due to a disruption in the physiological distance between the base of the sulcus and the alveolar bone (biological width), which results in a stress state on both structures. The biological width is defined as the sum of the epithelial junctional (0.97 mm) and connective tissue attachment (1.07 mm) components, resulting in an average biological width of 2.04 mm.[2,9]

A relatively short crown structure is indicative of functional crown lengthening, as it can maintain biological width. Furthermore, a functional crown lengthening procedure can also provide a supragingival structure of up to 2 mm or more in cases with subgingival cavities. This results in a fluoride effect that increases restoration resistance.[2]

In this case, a 2 mm sulcular incision was made on the mesiolingual and distolingual sides, and a 1 mm incision was made on tooth 35. The objective was to obtain the desired visibility for the crown lengthening procedure with bone removal. The biological width of tooth 35 was calculated to be sufficient at 2 mm, according to the patient's pre-procedural assessment. At the three-month follow-up appointment, the Resopack was removed. The patient exhibited no signs of discomfort, inflammation, or post-surgical incision opening. Subsequently, a zirconia crown was placed, and its acceptance was monitored. Additionally, at the 11th post-operative visit, tissue integration with the crown was observed, and the presence of inflammation was documented. The patient's pain levels were also evaluated during this period.

A positive outcome of root canal treatment is evidenced by the restoration of the periradicular bone structure. This can be observed in the radiographic image of the tooth after root canal treatment at the time of patient control. This was also observed in the above case. The radiographic image at the time of patient control shows that the radiolucent image at the apex of the tooth that has been retreated is smaller than before retreatment. This indicates healing of the bone structure.[6] The ferrule tooth tested stronger than the no-ferrule tooth. If you're restoring a damaged tooth, creating a ferrule will affect the existing tooth structure, which could weaken it. When there's no clinical crown, you'll need to create space for the ferrule at the expense of supporting bone to ensure adequate width and distance from the finish line to the attachment.[11]

4. Conclusion

The periodontal tissue is of significance for both dental aesthetics and function. The biological width serves to act as a barrier against microorganisms. In the context of restorations, consideration of the biological width is essential to avoid negative periodontal effects. Surgical crown lengthening can establish a healthy tooth structure. Root canal treatment is designed to protect the tooth structure and restore functionality. In the event of tooth structure loss, a post restoration is necessary.

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