Dentika Dental Journal
Journal homepage: https://talenta.usu.ac.id/dentika

Management of Traumatized Tooth with Cantilever Bridge

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ARTICLE INFO

Article history:
Received 26 February 2024
Revised 18 October 2024
Accepted 14 November 2024
Available online December 2024

E-ISSN: 2615-854X
P-ISSN: 1693-671X

How to cite:
Rustiqa FM, Farahanny W. Management of Traumatized Tooth with Cantilever Bridge. Dentika Dental Journal 2024; 27(2): 131-138

http://doi.org/10.32734/dentika.v27i2.15773

ABSTRACT

Dental trauma may lead to tooth loss despite various efforts to retain and maintain the compromised tooth. Several studies have shown that the upper anterior teeth are more likely to suffer from trauma. In addition, their loss can lead to significant aesthetic and functional problems that are difficult to manage. A 22-year- old patient came to RSGM Universitas Sumatera Utara with chief complaint of fractured tooth that impaired appearance. Clinical and radiographic examination showed complicated crown and root fracture on anterior maxillary teeth (Andreason classification). Diagnosis of the fractured tooth revealed the presence of necrotic pulp with asymptomatic apical periodontitis. Treatment plan for tooth 11 was endodontic treatment, while tooth 21 was extracted due to poor prognosis. Subsequently, aesthetic rehabilitation was restored with the use of cantilever bridge. Management of tooth 11 was carried with endodontic treatment using a rotary file under rubber dam isolation, followed by retraction with dental floss. Cantilever bridge was then used as final restoration to optimize the aesthetic result. In addition, 1 month follow up showed good outcome in the patient. Increased patient demand for optimal aesthetics had led to the widespread use of alternatives to restore aesthetic following post- traumatic endodontic treatment, such as cantilever bridge. Lithium disilicate was an indirect restoration material that could be bonded using the latest universal adhesive system and had excellent aesthetic for use in the repair of aesthetic disorders. Root canal treatment and cantilever bridge could serve as treatment options to manage anterior tooth fracture and anterior tooth loss caused by dental trauma.

Keyword: Traumatized Tooth, Tooth Fracture, Cantilever Bridge, Lithium Disilicate

ABSTRAK

Trauma gigi dapat menyebabkan kehilangan gigi meskipun berbagai metode terbaik telah dilakukan untuk mempertahankan dan merawat gigi yang terganggu. Gigi anterior atas lebih sering mengalami trauma, dan kehilangan gigi dapat menyebabkan masalah estetika dan fungsional yang signifikan yang sulit untuk ditangani. Seorang pasien berusia 22 tahun datang ke RSGM Universitas Sumatera Utara dengan keluhan utama gigi fraktur yang mengganggu penampilannya. Pemeriksaan klinis dan radiografi menunjukkan fraktur mahkota dan akar kompleks pada gigi rahang atas anterior. Diagnosis dari gigi tersebut adalah nekrosis pulpa dengan periodontitis apikalis asimtomatik. Rencana perawatan untuk gigi 11 adalah perawatan endodontik dan gigi 21 dicabut karena prognosis yang buruk. Rehabilitasi estetik diperbaiki dengan jembatan kantilever. Penatalaksanaan pada gigi 11 adalah perawatan endodontik. Perawatan endodontik dilakukan dengan menggunakan File rotari di dengan isolasi rubber dam dan retraksi dengan benang gigi. Jembatan kantilever digunakan sebagai restorasi akhir untuk mengoptimalkan hasil estetik. Kontrol satu bulan menunjukkan hasil yang baik. Meningkatnya permintaan pasien akan estetika yang optimal telah menyebabkan meluasnya penggunaan alternatif untuk mengembalikan estetik setelah perawatan endodontik pasca trauma, seperti jembatan kantilever. Lithium disilikat adalah bahan restorasi indirek yang dapat direkatkan menggunakan sistem perekat universal terbaru dan memiliki estetika yang sangat baik untuk digunakan dalam perbaikan gangguan estetik. Kesimpulan: Perawatan saluran akar dan jembatan kantilever dapat menjadi pilihan perawatan untuk mengatasi fraktur gigi anterior dan kehilangan gigi anterior akibat trauma gigi.

Keyword: Trauma Gigi, Fraktur Gigi, Jembatan Kantilever, Litium Disilicate

1. Introduction

Traumatic injuries to anterior teeth are one of the common problems faced by young children and adolescents. The leading causes of these injuries include accidents, contact sports, falls, and violence, with maxillary central incisors being the most commonly affected 9. Several studies have shown that trauma to the periodontal ligament and alveolar bones is also common, along with dental trauma [2]. In cases of any trauma to the facial region, the most affected teeth were the maxillary central incisors (83.8%) [3]. In addition, jaw fractures and dislocation of teeth have been reported to be the most common results after an orofacial trauma. Radiographic imaging, such as X-rays or CBCT, can help in evaluating the condition of a traumatized part, the bone, and neighboring teeth. When traumatized teeth have pulp involvement or signs of infection, endodontic therapy (root canal treatment) is usually required to preserve the integrity [4].

Managing traumatized teeth with a cantilever bridge comprises a careful and comprehensive method to ensure the best possible outcome for the patient. A Cantilever bridge is a dental prosthesis that replaces missing teeth by attaching a pontic (false tooth) to one or more adjacent natural variants (abutments) [5]. When one of the abutment teeth has been traumatized, management becomes more complex. A thorough examination and dental history are crucial to understanding the extent of the trauma to the affected part and its surrounding tissues [6].

After a traumatic injury is diagnosed, a treatment plan must be created based on factors such as the specific type of fracture, the stage of teeth development, the expected outcome of endodontic therapy, and issues related to periodontal health, restorative dentistry, and prosthodontics [7]. For complicated crown fractures, treatment options are vital pulp therapy and pulpectomy[6]. In addition, a cantilever bridge is a type of prosthesis that replaces teeth loss and is supported by one or more abutment teeth, only on one side [8]. From the management of this case, it was concluded that the cantilever bridge provided aesthetic results by giving a more natural impression of the maxilla anterior prosthesis. The Cantilever bridge is the best choice for dentists and patients with aesthetic demands and optimal function and tissue preservation [9]. Therefore, this case report aims to explain the management of traumatized teeth with a cantilever bridge.

2. Case Report

A 22-year-old patient came to RSGM Universitas Sumatera Utara with a significant complaint of a fractured tooth that impaired appearance. Clinical and radiographic examination showed complicated crown and root fractures on anterior maxillary teeth (Figure 1). The diagnosis of the tooth was necrotic pulp with asymptomatic apical periodontitis (Figure 2. a, b, c, d). In addition, the treatment plant for tooth 11 was endodontic treatment. In contrast, tooth 21 was extracted due to a poor prognosis resulting from a horizontal root fracture in the middle third of the root, along with dislodgement of the fractured fragment, which was observed on CBCT. (Figure 2. c,d,e). A few weeks after tooth extraction, there was a resorption of alveolar bone in region 21. Aesthetic rehabilitation was restored using a cantilever bridge with artificial gingiva.

Figure 1. Clinical Examinations

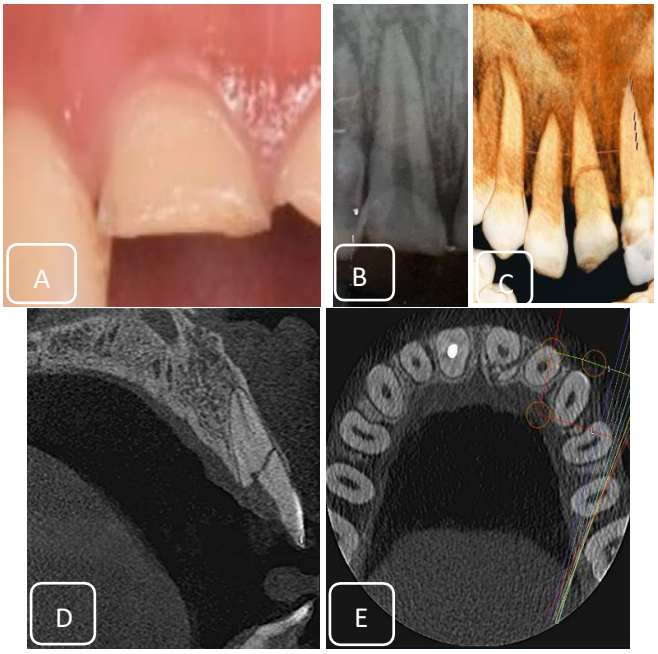

Figure 2. (a) Clinical examination on tooth 11; (b) Pre-operative radiograph on tooth 11; (c,d,e) CBCT on tooth 21

3. Case Management

In this study, there could be a loss of the front teeth as tooth 21 was to be extracted. The patient was concerned about the aesthetic factor and desired the natural color of teeth. In addition, the preferred treatment for tooth 11 was root canal therapy with lithium disilicate cantilever bridge and ovate pontic restorations. Detailed procedure was explained to the patient, and informed consent was obtained. On the first appointment, local infiltration was performed with an articaine of 2%, and isolation was carried out with a rubber dam. The access was established through an endo access bur. This study determined the working lengths using an electronic apex finder with a size #10 K-file and verified using radiography (Figure 3a). The root canal was prepared using the crown-down approach. Subsequently, the canals were cleaned and shaped using an E-flex blue file system. Each canal was prepared up to #25.06. Irrigation was performed with NaOCl 2.5% and saline between each instrument change and activated using an ultrasonic device. Paper points were used to dry out the canal, while calcium hydroxide was an intracanal medicament (Figure 3b).

The cavity was sealed with a temporary restorative material. During the second appointment, after isolation with a rubber dam, the canal was irrigated with NaOCl 2,5%, EDTA 17%, and saline and then dried. The trial of Master Apical Cone (MAC) was confirmed with a periapical radiograph (Figure 4 a). Obturation was performed with single cone gutta-percha with resin-based sealer, and Bulk-fill flowable resin was placed as an orifice barrier (Figure 4b). The patient was instructed to undergo control 2 weeks after obturation of tooth 11.

Figure 3. (a) Working length determination; (b) Calcium hydroxide medicament

Figure 4. (a) Trial MAC; (b) Obturation

In the third appointment, post-obturation control, subjective examination results showed no complaints from the patient after obturation. Radiographic examination revealed hermetic gutta-percha filling. In addition, the evaluation yielded objective results, indicating that the temporary filling was in good condition. Percussion and palpation tests showed no abnormalities. Subsequently, a composite resin restoration was performed as a long-term temporary solution. After obtaining informed consent, the patient's tooth 21 was extracted because it had a poor prognosis. After extraction, the patient was instructed to return after 1 month to allow time for tissue healing in the area after extraction (Figure 5a).

The following process was the preparation of the abutment teeth for the preparation of a single-unit cantilever bridge. The preparation stage started with making an orientation groove with a rounded tapered diamond bur in the labial and incisal areas. A 1.5 to 2 mm reduction was conducted on the labial, incisal, interproximal, and palatal surfaces 11. Preparation in the gingival area using a retraction cord (Ultra Dent Product USA) around the cervical teeth to facilitate the preparation of chamfer-shaped cervical endings (Figure 5b). Preparation results were checked with putty index, and bite records were obtained. After the preparation, the next stage was double impression molding and then a 2-step putty wash technique using elastomer consistency putty and light body molding materials to obtain accurate results. Subsequently, the casts were filled using plaster to get a working model and color selection was conducted, then sent to the dental laboratory to continue the denture design and manufacturing process using CAD/CAM, while teeth were made into prostheses. Due to the resection of alveolar bone and gingiva after extraction, an artificial gingiva was planned (Figure 6).

Figure 5. (a) After extraction, (b) Crown preparation tooth 11

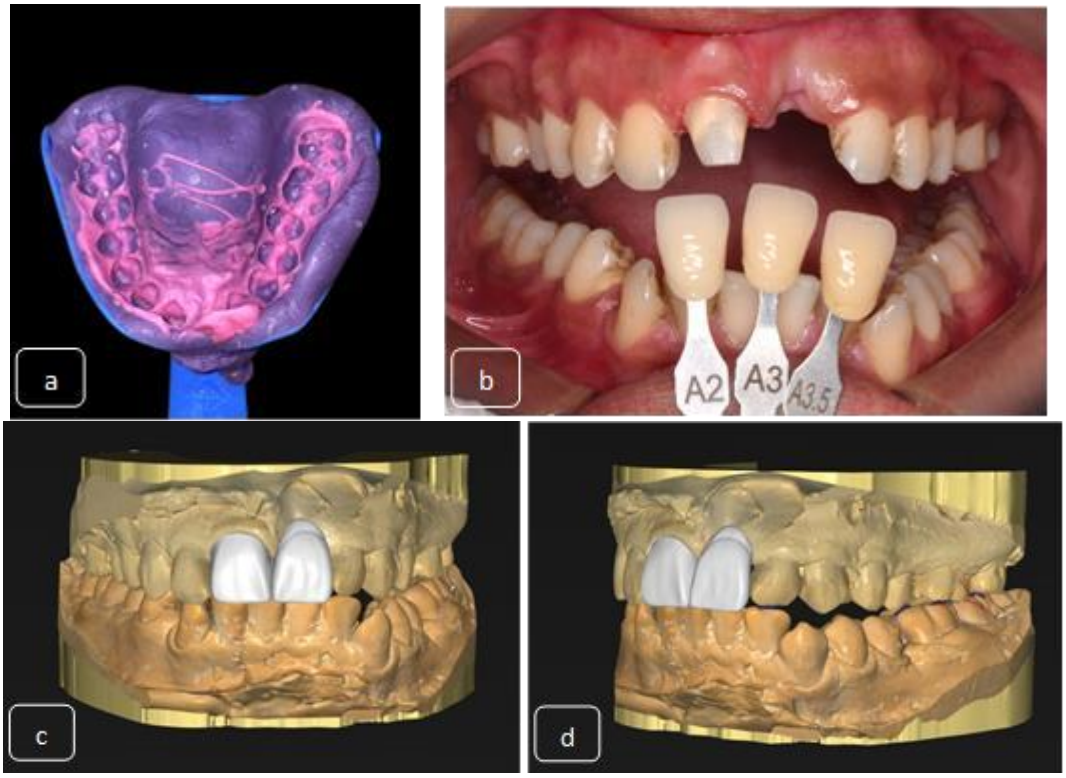

Figure 6. (a) Elastomer double impression; (b) Colour selection (c,d) CAD/CAM

After 1 week, a lithium disilicate cantilever bridge was installed. After a try-in, color, contour, embrasure, edge density, occlusion, and proximal contact were examined. This case showed that tooth 11 was clinically examined again. The examination revealed that tooth 11 was asymptomatic, there was no response to percussion and pressure tests, and there was no wobble or abnormality in the surrounding periodontal tissues. A trial placement of the cantilever bridge was performed and examined for color, contour, edge density, adaptation to the preparation, proximal contact, and occlusion endings. Before cementation, the tooth was isolated with politetrafluoroetilane (PTFE) (Figure 8a). The inside of lithium disilicate crown was applied 5% hydrofluoric acid for 60 seconds, washed under running water, and dried. After that, silane was applied for 90 seconds and sprayed with air. Cementation was carried out using dual-cure resin cement (RelyXTM Ultimate, 3M ESPE, USA) (Figure 8 b,c).

Figure 7. (a) Isolation politetrafluoroetilena; (b,c) 5% hydrofluoric acid

Any excess cement was removed and then irradiated for 20 seconds for complete hardening. After removing

PTFE using the articulating paper, the occlusion was checked again, and the proximal part was smoothened using a polishing strip (Figure 8). A radiographic examination was performed to observe marginal adaptation as well as proximal contact, and then the patient was asked to control 1 week later.

During the follow-up session after the insertion, lithium disilicate cantilever bridge was examined and found to be in good condition. The patient did not report any issues, and both objective and subjective examinations obtained negative results. In addition, the surrounding tissues also showed no signs of problems. Overall, cantilever bridge was properly positioned, and the patient had increased comfort compared to previous visits (Figure 9).

Figure 8. (a,b) Cementation cantilever bridge; (c) Verification of cementation by radiographic imaging

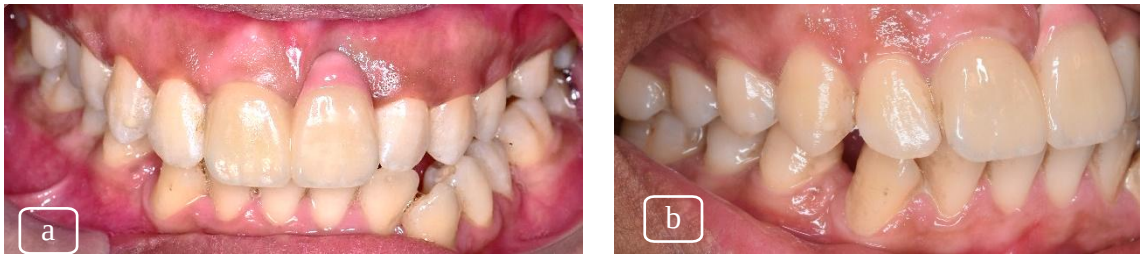

Figure 9. Post insertion control of lithium disilicate cantilever bridge (a) Labial view; (b) Buccal view

4. Discussion

Traumatic dental injuries had expanded at some point in the previous years, falls and collisions, physical activities, and accidents could cause such injuries. All over the world, 15.5% of teens and teenagers between 7 and 20 years old preserve trauma in at least 1 permanent tooth. Anterior teeth, particularly the maxillary central and lateral incisors, were susceptible to significant traumas [6]. Dental trauma could result in exceptional kinds of injuries depending on the quantity, direction, area of the effect, and enamel improvement stage. According to recent clinical classifications, crown, crown root, and root fractures were commonplace accidents to the hard dental tissues and the pulp. A crown fracture was displayed as cracks or fractures in the enamel and or dentin, with or without loss of tooth structure, and was defined as complex when the pulp was exposed after trauma and simple when the pulp was not exposed. When a fracture included tooth, dentin, and cementum and was extended under the gingival margin, it was defined as a crown-root fracture [10]. In root fractures, most effective the root structure, which included dentin, cementum, and pulp, is concerned, and it could be localized on the apical, middle, or cervical third.

Root fractures occurred in any direction and orientation and were generally categorized as vertical (usually involving the crown) or transverse (often referred to as horizontal) root fractures. For complicated crown fractures, pulp vital therapy and pulpectomy were available treatment options. In this case report, root canal treatment was performed on tooth 11 with a complicated crown fracture, while tooth 21 had an oblique fracture in the middle third of the root, where there were separate fracture fragments. The apical fractures generally required the least management and had the best prognosis, while coronal root fractures required the most complex management and had the worst prognosis.[21] On tooth 21, the root canal exploration procedure was difficult to reach the apical end, as the root canal was filled with granulation tissue, almost covering the entire diameter of the root canal. Cleaning and shaping were performed however could not clean the entire length of the root canal due to the apical displacement of the fracture fragments. Bleeding occurred every time cleaning and shaping were performed, therefore, it was not possible to achieve a dry

root canal condition. This situation led to obturation not being able to continue, resulting in a poor prognosis for tooth. Consequently, tooth was extracted because root canal treatment was not possible. Due to the extraction of tooth 21, resulting in the loss of anterior teeth, it was necessary to consider several factors because it involved aesthetics, appearance, and patient confidence. Determining the treatment plan also needed to consider function to ensure that the final restoration could restore the patient's function and aesthetics, then the final restoration was selected using cantilever bridge [11,12]. Other treatment options included removable partial dentures. However, it must be noted that partial removable dentures were less aesthetic [13].

Cantilever bridges proved to be an effective solution as a fixed restoration. Cantilever bridge was a type of prosthesis that replaced the loss of 1 tooth and was supported by 1 or more abutment teeth on a side only. This type of prosthesis was indicated to replace the loss of an anterior tooth, which received a relatively light occlusal load, according to Ante's law [8]. A pontic was a part of the prosthesis that replaced missing teeth to restore function and fill the edentulous area. The pontic must be able to restore masticatory function, aesthetics, and comfort, be biocompatible with surrounding tissues, easy to clean, and maintain the mucosa in the edentulous area [14]. In most cases, cantilever bridge was used for only 1 missing tooth and generally was not recommended for replacing lost molars or premolars. The design of the pontic played an important role, and proper planning was required in its manufacture. Some of the pontic designs that could be selected were sanitary pontic, conical pontic, saddle ridge-lap pontic, modified ridge-lap pontic, and ovate pontic [15,16]. The pontic shape used in this case was ovate pontic using lithium disilicate material.

Lithium disilicate was a glass-ceramic material that was used for many forms of restoration [17]. In addition, there were 2 widely available forms, namely ingots that could be melted and pressed (IPS e.max Press, Ivoclar Vivadent) and blocks that were milled using CAD/CAM (IPS e.max CAD, Ivoclar Vivadent). This material was recommended for crowns, inlays, onlays, or veneers [18]. Lithium disilicate exhibited good color dimensional stability and could be used in minimally invasive restorations [19,20]. According to Della Bona et al (2008), lithium disilicate-based restorations had a high survival rate. Strength Lithium disilicate crowns had a monolithic structure and a strength of 380 to 500 MPa. For aesthetics, these crowns were visually indistinguishable from natural teeth and did not have an opaque frame. Dentists could select the most accurate shade and transparency to match the patient’s natural dentition. The color of lithium disilicate crowns remained stable and did not change over time. Lithium disilicate was biocompatible, meaning it did not cause allergies or irritation. The material was well-tolerated by patients. With proper care, lithium disilicate crowns could serve for more than 15 years, preserving their original properties and appearance [21].

Due to alveolar bone resection in tooth 21 after extraction to increase aesthetics, the cervical pontic was modified with the addition of artificial gingiva. Restoration with artificial gingiva was indicated for patients with loss of alveolar ridge in anterior zone [22].

5. Conclusion

In conclusion, root canal treatment and cantilever bridge could be a choice of treatment to manage anterior tooth fracture and loss as a result of dental trauma. The ultimate goal of endodontic treatment was to maintain or restore dental and supporting tissues to ensure that a dentition that functioned properly, comfortably, and aesthetically well was achieved. From the results of this case management, it was concluded that the ovate pontic design provided aesthetic results by giving a more natural impression of the maxillary anterior prosthesis. This design was the best choice for dentists and patients with aesthetic demands and optimal function and tissue preservation. Good communication between the dentist and dental technician was required, as the patient's oral hygiene standards needed to be maintained on a long-term basis to maintain the health of the tissues surrounding the restoration.

6. Conflicts of Interest

The authors declare no conflicts of interest.

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