

CASE REPORT

Fiber Reinforced Composite Posts as A Follow-Up After Root Canal Treatment in Class III Ellis Fractures of Anterior Teeth

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ABSTRACT

Anterior tooth fractures in children are often caused by their active lifestyles. If these fractures affect only the enamel or dentin, composite restoration suffices as treatment. However, if the damage extends to the pulp, root canal therapy becomes necessary before final restoration. One of the advantages of fiber reinforced composite (FRC) posts is that they provide additional strength to the tooth after root canal treatment, helping to prevent further cracking or fracturing. This case report focuses on treating Class III Ellis fractures of anterior teeth in an 11-year-old boy who had sustained injuries. The fractured teeth caused pain and required root canal treatment due to pulp involvement. The patient in this case report used FRC posts after root canal treatment because the tooth crown fractured more than half of the crown and the canal walls were thin because the pulp canals in young adult teeth were still wide. FRC posts offer elasticity, translucency, adaptability, and resistance to friction and impact, making them a valuable alternative to conventional posts for post-traumatic anterior tooth fractures.

Malaysian Journal of Medicine and Health Sciences (2024) 20(SUPP12) 196-199. doi:10.47836/mjmhs.20.s12.28

Keywords: Anterior tooth fracture, Crown fracture, Clas III ellis fracture, Root canal treatment, Fiber-reinforced composite posts

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INTRODUCTION

The anterior teeth play a crucial role in enhancing a person's facial appearance. Moreover, the impact on the overall quality of life due to dental trauma is significant. Facial injuries can lead to broken, displaced, or missing teeth, which can profoundly affect the functional, aesthetic, and psychological well-being of young individuals. The principal causes of permanent tooth injuries are typically linked to road traffic accidents, sports-related accidents, falls, and acts of violence. Participating in sports activities carries a risk of orofacial injuries due to falls, collisions, or contact with hard surfaces. The prevalence and types of injuries exhibit significant variations across different countries. Injuries caused by trauma mainly impact children, with the highest occurrence observed between the ages of 2-4 years and 8-10 years, affecting boys more frequently than girls(1) The prevalence of dental trauma in Indonesia is

around 11.4% and often occurs in children aged 7–12 years. The majority of dental injuries were associated with falls, often occurring during activities such as biking or skateboarding. Additionally, injuries were commonly linked to participation in contact sports, for example, football, hockey, rugby, judo, and karate.(1)

According to the available literature, the upper and lower central incisors are the most frequently affected teeth, as they are often the first to sustain direct impacts leading to fractures. The next most commonly injured teeth are the maxillary lateral incisors, followed by the mandibular central and lateral incisors. In cases where the pulp of anterior teeth is affected by trauma, a root canal treatment is necessary before proceeding with the restoration of the tooth crown.

Effective management of a fractured tooth not only demands a well-sealed root canal treatment but also requires vigilant post-treatment care to ensure a durable restoration without causing further harm to the tooth. Traditionally, teeth treated endodontically with damaged crown structures are rehabilitated using a post and core, which is then followed by the placement of a

prosthetic crown.(2) To enhance stability and to prevent detachment or fractures, an optimal core and post system becomes imperative.

Consequently, in recent years, prefabricated glass fiber posts have come into consideration as a substitute for custom-made metal posts.(2,3)

CASE REPORT

On September 26, 2022, an 11-year-old male patient, identified as SRA, presented at the pediatric dental clinic of RSGM Unpad with the primary concern of a fractured tooth, which had resulted from a fall at school three days prior. During the extraoral examination, there were no signs of swelling in the vicinity of the mouth and face, and no cuts were evident on the lips and oral lining. In the intraoral examination, two upper front teeth exhibited fractures extending beyond half of the incisal edge. Both teeth showed positive results on the percussion and palpation tests, indicating a degree of mobility at level 1. Radiological assessment revealed pulp-involved fractures in teeth 11 and 21. No irregularities were observed in the periapical region of tooth 21 (Figure 1). The treatment plan for this patient is root canal treatment for both teeth. At the subsequent appointment, pulp removal, cleansing, and shaping procedures were carried out on teeth 11 and 21. Afterward, calcium hydroxide medication was applied as an interim medication. The next appointment was arranged for one month after the second visit to obturate both teeth (Figure 2). At the follow-up visit for root canal treatment, there were no issues raised concerning teeth 11 and 21 (Figure 2). Following that, preparations were made for the insertion of FRC posts in this patient. A specific bur was used to extract gutta-percha material from the root canals, leaving around 7 mm of gutta-percha material remaining inside the canals. Once all the gutta-percha had been removed from two-thirds of the root canal length, the FRC posts were then inserted. Following the insertion of FRC posts, the subsequent step involves preparing the tooth crown to facilitate the construction of a core build up (Figure 3). An impression is made of the prepared teeth, and a meticulous color matching process is conducted to determine the most appropriate shade for the crowns of teeth 11 and 21. Once the

crowns for teeth 11 and 21 were completed by the technician, the patient SRA was requested to return to the pediatric dentistry clinic for the crown placement process. Once it was confirmed that the crowns fit well, the final step involved the meticulous application of dental cement to securely affix the crowns in place, thereby completing the crown placement procedure (Figure 4). The next appointment was scheduled for a three-month follow-up after the crown placement. During this particular visit, X-ray imaging, clinical

examination, and the removal of dental calculus were carried out. The dental calculus removal procedure was deemed necessary due to a substantial accumulation of dental calculus on the patient’s teeth, indicative of a suboptimal oral hygiene status. After the scaling procedure, the patient received oral hygiene instructions to help improve their ability to maintain better oral health and dental hygiene practices (Figure 4).



Figure 1. Clinical photo and radiological image of the patient’s teeth before treatment.

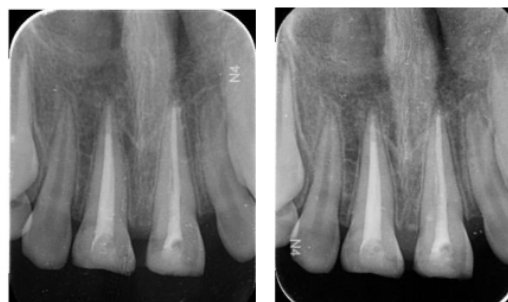


Figure 2. Radiological image of root canal obturation, radiological image of 1 month control post obturation



Figure 3. Preparation and placement process of FRC, core preparation, and the final result of FRC and core build up.



Figure 4. Lithium disilicate placement on the upper central incisors, 3-month follow-up visit radiological image of the patient.

DISCUSSION

Traumatic dental injuries (TDI) result from specific factors that can accumulate over time if left unaddressed, impacting both mastication function and aesthetics. Research indicates that dental injuries tend to increase as children age from 9 to 12 years. The prevalence of injuries in older individuals does not necessarily imply greater susceptibility, as these injuries are often cumulative in nature. Root canal treatment is a common dental procedure for teeth with pulp involvement. Cleaning and shaping the root canal is a critical phase, with the goal of removing organic debris and microorganisms from the complex root canal system. Irrigant solutions are used to flush the system and inhibit microbial growth. Gutta-percha has been the primary material for root canal fillings, as alternative materials like silver points raise concerns regarding corrosion and clinical failures. A standard root filling combines sealer cement and a gutta-percha core, with the sealer's biocompatibility and sealing ability being essential properties for effective root filling. After completing the root canal treatment using gutta-

percha, the next step is to consider the restoration process, which involves deciding whether to use posts. This patient has lost more than half of the tooth crown fracture, necessitating the placement of a post prior to restoration. While metal posts have been traditionally used, non-metallic posts have been introduced to meet the demand for more aesthetically pleasing materials, especially in the anterior region. In recent years, significant progress has been made in the development of bondable, fiber-reinforced, and ceramic esthetic posts to strengthen teeth that have undergone endodontic treatment. It's important to note that the presence of a metal post can create shadows on the soft tissues surrounding the root surface, which can negatively impact the desired esthetic outcome when using bonded resin and ceramic restorations in the anterior region. Composite resin is a commonly used material for aesthetic dental restoration. FRC has emerged as a viable option, providing adhesive and aesthetic properties without the use of metal materials, even for molars.

FRC posts offer benefits such as high tensile strength, resistance to degradation and solubility, low electrical conductivity, and improved clinical performance. Over time, more radiopaque FRC posts were developed by incorporating quartz and glass fibers, enhancing their esthetic appeal. In the field of dental restoration, composite resin is widely used for its aesthetic properties.(4,5) Post cementation is necessary when the remaining tooth structure is inadequate to support the restoration, like teeth 11 and 21 in this patient. FRC posts can be used if root canal length allows for proper post placement with a minimum remaining apical seal length of 4 mm. The need for postplacement in teeth that have undergone endodontic treatment is associated with weakened tooth structure caused by fractures or trauma. The degree of weakness is directly related to the amount of dentin loss. Research suggests that the use of fiber posts and resin composite cements can help reduce the risk of root fractures or post-debonding. Generally, when there is insufficient remaining coronal structure to ensure restoration retention, the use of an intraradicular post is indicated. FRC posts offer several advantages over traditional metal posts. When a dual-cure luting agent

is combined with an FRC post, it facilitates physical and potentially chemical interactions with the reinforcement material and dentine, improving adhesive interfacial continuity. Composite resin cements, with their lower viscosity, enhance contact with the dentine bonding agent, promoting better intra-radicular adaptation. The elastic properties of low modulus composite resin compensate for polymerization shrinkage stress, reducing gap formation and microleakage. Additionally, lower-viscosity resin cements improve wetting capacity and minimize void formations, resulting in a stronger and more sealed root-restorative complex.(5) Composite resin offers secondary optical properties, such as translucency, opacity, opalescence, iridescence, and fluorescence. These properties allow light to interact with the natural tooth and restorative material, reflecting, refracting, absorbing, and transmitting based on the optical densities of hydroxyapatite crystals, enamel rods, and dentinal tubules. The fiber-reinforced composite resin system offers corrosion resistance and compatibility with restorative materials, providing structural design benefits. Metal posts are rarely used due to their limitations, which is why in this patient, it was decided to use FRC after root canal treatment and before the placement of lithium disilicate crowns. The use of a lithium disilicate crown in this patient aims to improve aesthetic function and extend the life of the restoration.

The patient returned to the Pediatric Dentistry Clinic at RSGM Unpad for a 3-month follow-up after the crowns were placed. During the patient's interview, no pain complaints were found. The patient underwent periapical X-ray imaging, and the results showed no signs

of cracked or broken tooth roots, with the periodontal tissue surrounding teeth 11 and 21 within normal limits. This aligns with existing theories that FRC posts are safe and a suitable option for post placement prior to crowns.

CONCLUSION

Fiber-reinforced composite (FRC) posts are being used as an alternative to traditional posts for treating post-traumatic anterior tooth fractures. FRC post is considered to be used in this patient after RCT compared to metal post because FRC post has more resilience and is better in aesthetics.

ACKNOWLEDGEMENT

The author wishes to extend their appreciation to the patient and his parents who participated in this study and granted permission for its publication. The author also expresses gratitude to the DRPM Universitas Padjadjaran for their support.

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