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Management of Avulsed Incisors Due to Trauma in a Growing Child: A Case Report

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Abstract: ***This case report describes the management of a 11-year-old male child with traumatic avulsion of both maxillary central incisors, where the teeth could not be recovered. Due to ongoing skeletal growth, implant placement was not an immediate option. A modified Groper appliance was used to restore esthetics and function while preserving space for future rehabilitation. The case highlights the importance of a growth-sensitive, multidisciplinary approach in managing anterior tooth loss in pediatric patients.***

Keywords: Tooth avulsion, pediatric, maxillary incisors, Groper appliance, space maintenance

1. Introduction

Traumatic dental injuries (TDIs) are widespread, impacting around 15% of the global population and compromising the oral health of nearly one billion individuals worldwide.[1] Traumatic dental injuries are prevalent among children and adolescents, often resulting in the loss of anterior teeth, particularly the maxillary central incisors. Among these injuries, avulsion represents one of the most severe forms, leading to immediate functional, esthetic, and psychological consequences. Avulsions are most frequently seen in the permanent dentition of children aged 8 to 12 years, a period during which the periodontal ligament is loosely organized and the erupting teeth often have short, incompletely developed roots. The incidence of tooth avulsion accounts for approximately 1% to 16% of all traumatic injuries affecting the permanent dentition.[2] The anterior region plays a critical role not only in facial esthetics but also in essential functions such as mastication, speech, and social interaction. Therefore, timely and appropriate prosthetic rehabilitation is crucial in pediatric patients with missing anterior teeth.

In growing children, space maintenance and functional replacement of lost teeth must be carefully planned to support or accommodate craniofacial development. The Groper's appliance, a fixed partial denture designed primarily for young patients, has been widely used to address anterior tooth loss by providing esthetic replacement and improving function. However, traditional designs may inadvertently limit natural growth, particularly in cases requiring maxillary arch development or expansion.

To overcome these limitations, modifications to the conventional Groper's appliance can be made to allow for continued arch growth and transverse expansion, making it a more growth-compatible option. These growth-enabling modifications are especially important in mixed dentition stages, where unrestricted maxillary development is essential for establishing proper occlusion and facial harmony.

This case report describes the management of an 11-year-old male child with missing maxillary central incisors due to avulsion following a traumatic car accident. A modified, growth-enabling Groper's appliance was fabricated to restore anterior esthetics, mastication, and phonetics while simultaneously allowing for ongoing maxillary arch expansion.

2. Case Presentation

An 11-year-old male patient reported to the Department of Pediatric and Preventive Dentistry with the chief complaint of missing teeth in the upper front region. The patient had sustained dental trauma in a road traffic accident and was previously admitted to KVG Medical College and Hospital for emergency care. According to the history provided by the parents, the maxillary central incisors were avulsed during the accident, and the teeth could not be retrieved from the site of trauma.

Extraoral examination revealed a well-oriented child with no apparent abnormalities in general appearance, height, weight, or body build. Facial symmetry and lip competency were normal. A linear scar with healed sutures was observed on the left ear pinna, consistent with the history of trauma. There were no other notable extraoral findings.

Figure 1: Extraoral photograph showing missing anterior teeth due to avulsion

Intraoral soft tissue examination revealed healthy gingiva with no signs of laceration, swelling, or scarring. On hard tissue examination, missing maxillary central incisors (teeth 11 and 21) were noted. Additionally, dental caries was present in relation to teeth 55 and 65. The surrounding alveolar ridge appeared normal in contour and consistency, with adequate space for prosthetic replacement of the missing teeth.

The parents expressed concern regarding the esthetic, functional, and psychological impact of the missing anterior teeth and were keen on restoring the child's smile and oral functions at the earliest.

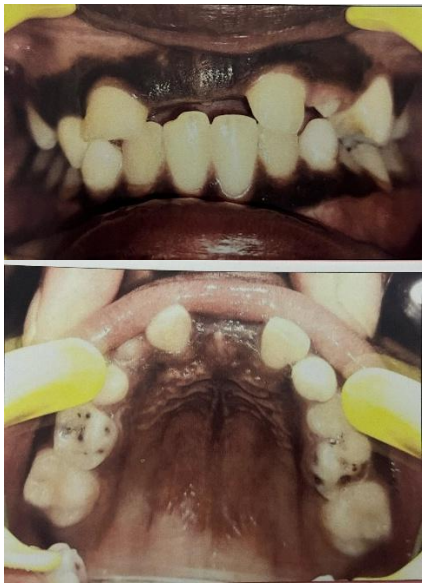

Figure 2: Intraoral photographs showing avulsed teeth of 11 and 12.

3. Treatment Planned

The decayed teeth in relation to 55 and 65 were planned for restoration and were subsequently restored. Considering the child's age and the need for an appliance that would not interfere with ongoing maxillary arch development, a growth-enabling modification of the Groper's appliance, a fixed space maintainer, was planned for anterior esthetic and functional rehabilitation.

Figure 3: Appliance in place (intraoral occlusal view).

The appliance was placed and the patient and his parents were provided with hygiene instructions. Follow up was scheduled every 3 months to keep in check. The patient did not express any discomfort related to the appliance during the observation period.

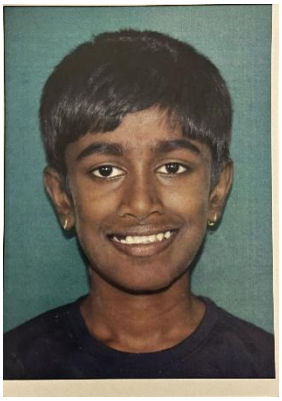

Figure 4: Post OP photograph (Extraoral frontal view)

4. Fabrication of the appliance

At the initial appointment, stainless steel molar bands were selected and adapted to either the maxillary first permanent molars or sound deciduous molars, depending on dental development and suitability. Following band selection, maxillary impressions were taken with the bands in place to obtain an accurate working cast. Once the bands were transferred to the cast, appliance fabrication commenced.

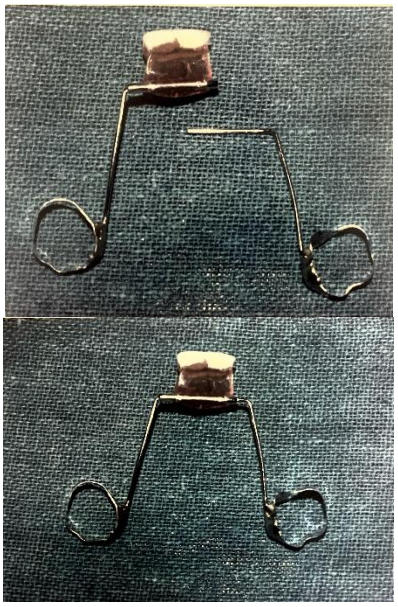

Figure 5: The appliance design (Growth – enabling modified fixed palatal maintainer)

Two segments of 1 mm orthodontic stainless steel wire were contoured along the palatal gingival margin, extending from the molar bands on either side toward the anterior edentulous space. The distal ends of the wires were bilaterally soldered to the palatal surfaces of the molar bands to ensure stability.
To accommodate maxillary growth, a telescopic sliding mechanism was incorporated into the design. A stainless steel tube, with an internal diameter slightly larger than the archwire, was soldered onto one of the contoured wires. The free end of the opposing archwire was inserted into this tube, allowing it to slide passively and adapt to transverse growth. A reference mark was made on the sliding wire using a diamond disk to allow monitoring of any movement during follow-up visits.

Artificial acrylic teeth matching the size, shape, and color of the missing central incisors were selected. Pink acrylic resin was contoured to simulate gingival tissues and used to bond the prosthetic teeth onto the wire framework in the anterior region. The appliance was polymerized in a hydroflask to ensure durability, then removed from the cast and finished with appropriate trimming and polishing.

Following a successful try-in and necessary occlusal adjustments, the final appliance was cemented in place using glass ionomer cement in the same appointment.

5. Discussion

Dental trauma involving the anterior maxillary region is a frequent occurrence in the pediatric population, with avulsion of the central incisors being among the most severe consequences. Avulsion not only compromises the esthetic appearance of the child but also affects essential functions such as phonetics and mastication, and can have significant psychosocial impacts[3]. According to the guidelines recommended by the International Association of Dental Traumatology (IADT) replantation is, in most situations, the treatment of choice for avulsed teeth but cannot always be carried out immediately[4]. In the present case, the avulsed teeth could not be retrieved from the site of trauma.

In pediatric patients, the replacement of missing anterior teeth presents a unique challenge. In growing patients, autotransplantation of teeth to replace missing incisors can be considered if suitable donors are available in the mouth[5]. Andreason et al reported survival rates of 95% and 98% for teeth transplanted with incomplete and complete roots, respectively[6]. However, despite some advantages over the teeth replacement inflammatory or replacement resorption of teeth are recognised as the major complications. In the present report the patient was in mixed dentition stage and probably the usage of donor teeth and the remaining space would affect the future definitive treatment decision. Implant replacement offers a more favorable option for preserving the dimensions of the alveolar process and preventing further ridge resorption. However, due to concerns about interference with normal growth, implant placement is not recommended until skeletal development is complete. Another treatment option in such cases is orthodontic space closure, which involves moving the lateral incisors into the space of the missing central incisors. This approach requires a thorough evaluation of the patient's age, occlusion, space availability, and the shape and size of the adjacent teeth[7]. However, achieving optimal esthetics with this method can be challenging due to dental asymmetry and the reduced cervical width and height of lateral incisors compared to central incisors, often resulting in an unsatisfactory gingival contour.

Conventional prosthetic solutions must be carefully selected and designed to accommodate the ongoing craniofacial growth. Fixed options such as Groper's appliance first introduced in 1984, are widely used for anterior tooth replacement due to their favorable esthetic outcomes and good patient compliance[8]. The appliance is a fixed esthetic space maintainer that incorporates artificial teeth into a band and loop framework. It is especially useful in cases of early anterior tooth loss in the primary or early mixed dentition stages.

However, the conventional Groper's appliance may pose limitations in older children where maxillary expansion is still occurring or anticipated. Rigid frameworks may restrict the transverse growth of the maxilla, potentially leading to future malocclusion or crowding. To address this, modifications to the appliance can be made to allow for continued maxillary development.

Changes in intercanine arch width and perimeter mostly occur during the transition from the mixed to the permanent dentition. Dincer et al. conducted a study to evaluate the effects of removable space maintainers on the growth and development of the maxillary and mandibular dental arches. The study reported a significant increase in arch width among untreated control subjects, whereas patients treated with removable space maintainers showed no change in intercanine width. Various designs of fixed space maintainers incorporating a pontic on the anterior segment of the wire have also been proposed. However, these appliances may interfere with maxillary growth, as they lack active expansion capability beyond the inherent flexibility of the arch wire, and often require periodic replacement.

In 2019, Volkan Arikan et al. introduced a growth enabling modified Groper appliance that not only improves the aesthetics of patients with missing anterior teeth but also facilitates transverse growth of the maxilla. In the present case, this growth-enabling modification of the Groper's appliance was used. The design incorporated features that maintained the anterior space and restored esthetics, phonetics, and mastication while allowing natural arch expansion. The in-tube mechanical design of the device allowed transverse growth of the maxilla without interference during and throughout long-term wear. By avoiding rigid palatal components or transverse connectors that could impede growth, the modified appliance preserved the functional and developmental needs of the patient.

This case reinforces the importance of individualized treatment planning in pediatric dentistry, where prosthetic rehabilitation must not only fulfill the immediate esthetic and functional requirements but also accommodate future growth and development. Growth-enabling appliances offer a valuable solution for managing anterior tooth loss in growing children, especially when conventional space maintainers may interfere with natural development.

6. Conclusion

Early loss of anterior teeth due to trauma can significantly impact a child's oral function, esthetics, and psychological well-being. Prosthetic rehabilitation in such cases must be carefully planned to meet both immediate and long-term needs, particularly in growing children. The use of a growth-enabling modified Groper's appliance in this case successfully restored esthetics, phonetics, and mastication while allowing for natural maxillary arch development. This approach highlights the importance of designing pediatric prosthetic appliances that support growth, function, and

patient confidence in a minimally invasive and child-friendly manner.

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