DOI : http://doi.org/10.64805/jnda.v24i2.202407

A Multidisciplinary Approach to Trauma and Healing of a Severely Rotated Maxillary Central Incisor: Case report

Kiran Poudel,[1] Bandana Koirala,[2] Mamta Dali,[3] Aagya Bhusal[4]

[1-3]Department of Pedodontics and Preventive Dentistry, College of Dental Surgery, B.P. Koirala Institute of Health Sciences, Dharan, Nepal,

[4]Department of Periodontics and Oral Implantology, Pokhara Academy of Health Sciences

Correspondence :

Kiran Poudel. Email: Keeran0516@gmail.com

ABSTRACT

Dental trauma in children can cause long-term functional, esthetic, and psychological consequences, especially when maxillary central incisors are affected. This case report describes an 11-year-old male, three years after a bull attack, presenting with severe mesiolabial rotation of tooth 11 and soft tissue entrapment between 11 and 12. The condition compromised the esthetics, oral hygiene, and self-esteem of the patient. Management involved slow maxillary expansion with a jackscrew supported by a transpalatal arch, derotation with a 2×4 appliance, and supracrestal fiberotomy to prevent relapse. Soft tissue corrections included vestibuloplasty and frenectomy with revision, as there was high gingival attachment of the frenum. Retention was maintained using a bonded palatal retainer from 12 to 22. At the 10-month follow-up of the retention phase, the patient demonstrated stable alignment, improved esthetics, healthy soft tissues, and enhanced psychological well-being. This successful outcome underscores the effectiveness of a multidisciplinary phased approach in managing complex pediatric dental trauma.

Key words: Tooth rotation; traumatic dental injury; 2×4 appliance.

INTRODUCTION

Traumatic dental injuries (TDI) are more than just physical harm. They can deeply affect speech, facial appearance, self-confidence, and overall quality of life. These incidents require immediate and expert care to prevent long-term functional and emotional consequences.[1] An oral injury accounts for approximately 5% of all physical injuries, with a 17% prevalence in preschool-aged children.[2] Nearly 80% of the dental injuries occur under the age of 20, with boys being affected twice as often as girls.[3] Permanent teeth (58.6%) are more frequently involved than the primary teeth (36.8%), and hard tissue injuries (64.5%) are more common than the soft tissue injuries (12.9%). Maxillary anterior teeth are most frequently affected in both dentitions, with the maxillary central incisors being involved in nearly two-thirds of all the cases (66.7%), emphasizing the esthetic and functional significance of timely intervention.[4]

The etiology of TDI most commonly includes falls, sports activities, road traffic accidents, and violence, while rare causes such as animal-related

Citation
Poudel K et al. A Multidisciplinary Approach to Trauma and Healing of a Severely Rotated Maxillary Central Incisor: Case report. J Nepal Dent Assoc. 2024 Jul-Dec;24(39):43-7.

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injuries are more often reported in rural regions having frequent human-animal interactions. In the primary dentition, traumatic injuries most often present as concussion and luxation, and in the permanent dentition, uncomplicated crown fractures are the most frequent type of injury. Notably, animal-related trauma, such as bull horn injuries, represents a severe form of dental trauma that often results in significant tooth displacement and complex management challenges.[5] This paper highlights the importance of a multidisciplinary approach in managing the orodental traumatic injury caused by a bull attack.

CASE REPORT

An 11-year-old male child reported to the Department of Pedodontics and Preventive Dentistry, with the chief complaint of an irregularly positioned upper front tooth and entrapment of gum for the past three years. The condition was associated with difficulty in brushing and pain. History revealed trauma from a bull attack three years back while working in the field, resulting in injuries to both the mouth and face. This was the patient's first dental visit, and the medical history was noncontributory.

On the clinical examination, the extra-oral view revealed a convex facial profile with a bilaterally symmetrical face and competent lips. An irregular scar of approximately two centimeters(cm) was noted over the right supra-orbital region, consistent with a healed traumatic injury. Intra-oral examination showed entrapment of soft tissue with a displaced labial frenum between 11 and 12. Poor oral hygiene with mild gingivitis was also noted. On the hard tissue examination, mixed dentition with Angle's Class I malocclusion and approximately 70% mesiolabially rotated maxillary right central incisor with two millimeters(mm) apical displacement were evident (Figure 1).

Pulp sensibility tests of 11 showed a positive response, indicating vital pulp. An orthopantomogram (OPG) confirmed mesiolabially rotated 11 with no any periapical pathology (Figure 2). Moyers' mixed dentition analysis revealed a space deficiency of –1 mm in the maxillary right quadrant and –0.5 mm in the left quadrant. Transverse analysis using McNamara's method showed an inter-canine and an inter-molar width of 24 mm and 35 mm, respectively.

Figure 1: Pre-operative view, (A) Right lateral view, (B) Frontal view, (C) Left lateral view.

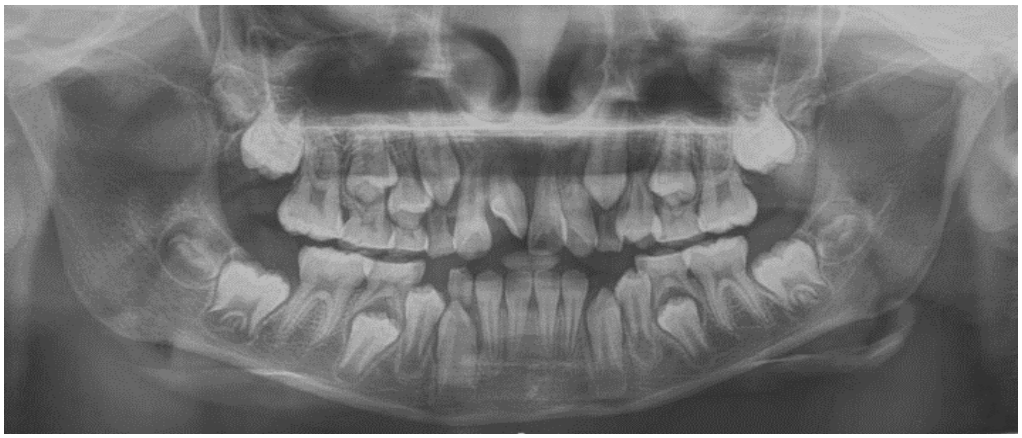

Figure 2: Orthopantomogram(OPG).

A final diagnosis of Angle's Class I malocclusion with mesiolabial rotation and apical displacement of 11 with soft tissue entrapment and aberrant labial frenum attachment between 11 and 12 was made. The treatment plan was formulated following the interdisciplinary consultations with the departments of Orthodontics and Periodontics. This led to the planning of a comprehensive orthodontic treatment followed by adjunctive periodontal therapy. Thereafter, written informed consent and assent were obtained from the parents and patient alike.

A removable appliance using an active acrylic plate with a jack-screw was fabricated for slow maxillary expansion (SME) (Figure 3A). With the activation of the screw (one-quarter turn every three days for three weeks), three mm expansion was achieved. Considering the severity of rotation, a 2×4 fixed appliance was chosen, engaging the maxillary first permanent molars, central, and lateral incisors.

Following expansion, a transpalatal arch with molar bands with buccal tubes was placed bilaterally on the maxillary first permanent molars. Orthodontic brackets (0.022" MBT slot) were bonded on teeth 11, 12, 21, and 22 (Figure 3B). The arch-wire sequence began with 0.012" NiTi, progressing to 0.014" and 0.016". After three months, significant derotation of 11 was achieved, and a 0.016" stainless steel archwire was placed for the stabilization of tooth 11 (Figure 3C).

After correction of rotation, surgical procedures with supracrestal fiberotomy, frenectomy, and vestibuloplasty were performed. A circumferential incision was then made around 11 to sever the trans-septal and supra-crestal fibers, to minimize the post-operative relapse. Frenectomy was performed to release the entrapped soft tissue between 11 and 12. Vestibuloplasty procedure involved deepening of the vestibule to improve the oral hygiene, and reduce further muscle pull during lip movements. Suturing with 4-0 silk suture and Coe-Pack dressing was given for one week. (Figure 4)

At the four months of follow-up, a 0.019×0.025" rectangular stainless-steel wire was placed for torque control and stability. During this stage, an

Figure 3: (A) SME using jackscrew, (B) 2×4 fixed appliance, (C) Derotation achieved in 3 months.

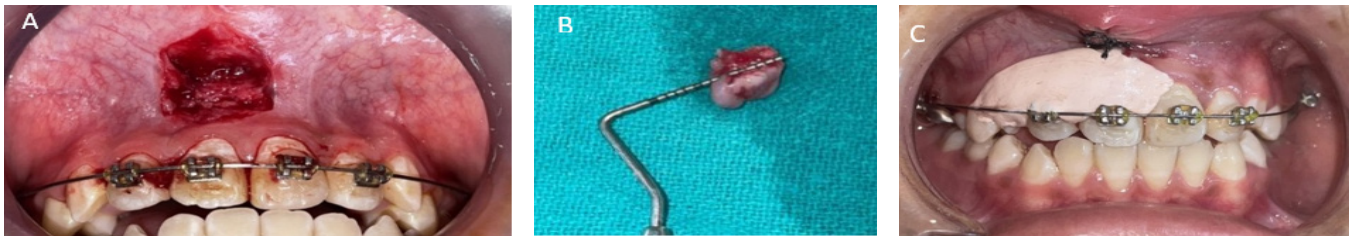

Figure 4: (A) Supracrestal Fiberotomy, Labial Frenectomy, and Vestibuloplasty, (B) Excised tissue, (C) Suturing followed by Coe-Pack placement.

Figure 5: Ten-month follow-up of the retention phase, (A) Frontal view, (B) Palatal view.

aberrant frenum attachment near the marginal gingiva of tooth 11 was noted, posing a risk for recession; thus, re-frenectomy was planned.

At the five-month follow-up, satisfactory wound healing was observed. Subsequently, orthodontic brackets were removed, and a fixed palatal retainer was bonded between 12 and 22. At the ten-month follow-up of the retention phase, satisfactory healing, esthetics, and occlusion were maintained (Figure 5).

DISCUSSION

The present case describes an unusual sequela of traumatic dental injury caused by a bull attack, resulting in a 70° mesiolabial rotation of the maxillary right central incisor with apical displacement and soft tissue entrapment. Although rotation is not a typical outcome of dental trauma, it can occur due to post-traumatic disruption of the periodontal ligament and subsequent malpositioned healing. In children, the resilience of the alveolar bone and incomplete root formation may allow displacement of the teeth without fracture, explaining the clinical presentation observed in this patient.[6]

Tooth rotation is classified as a positional change in which a tooth turns around its long axis, either mesiolingually or distolingually. Management of rotated teeth can be carried out using removable, semi-fixed, or fixed appliances, depending on severity and patient compliance. Removable appliances, although simple, are limited to tipping movements and pose challenges such as appliance loss, breakage, interference with speech and mastication, and risk of gingival inflammation or caries. In contrast, fixed appliances minimize dependence on compliance, provide three-dimensional control, and allow for more predictable tooth movement. Gupta et al. [7] categorized rotations into three categories: mild (<45°), moderate (45–90°), and severe (>90°). Previous studies have demonstrated that rotations exceeding 45° are unlikely to resolve spontaneously and often require fixed appliance therapy for any predictable correction. In this case, as the rotation was moderate and the patient was in the mixed dentition stage, comprehensive orthodontic treatment using a 2×4 appliance was planned.

The 2×4 appliance is particularly effective in the mixed dentition as it permits controlled derotation, alignment, and vertical positioning of the anterior teeth with good anchorage from the molars.[8] In the present case, the use of a 2×4 appliance with NiTi archwires successfully achieved derotation within three months, followed by the stainless steel and rectangular arch-wires for stabilization and torque control. A similar report by Radhika et al.[9] has documented successful correction of such severe rotations within three to four months using this technique, supporting its reliability and correction potential.

Relapse of the tooth after orthodontic correction has always been a great challenge. When a rotated tooth is corrected orthodontically, the surrounding collagen fibers of the periodontal ligament become stretched. These fibers retain residual forces even after the treatment, which can pull the tooth back

towards its original position, leading to rotational relapse. Therefore, circumferential supracrestal fiberotomy was advocated to release soft tissue tension and facilitate reattachment of the fibers after the orthodontic correction of the tooth rotation.[10] Frenectomy and vestibuloplasty addressed the aberrant labial frenum and soft tissue entrapment, improving esthetics, oral hygiene, and the vestibular depth.

SUMMARY

This case illustrates the effectiveness of a multidisciplinary approach in managing a severely rotated maxillary central incisor with soft tissue entrapment in an 11-year-old male following trauma caused by a bull attack. It underscores the challenges of delayed presentation and the complexity of animal-related dental injuries. Although the treatment was initiated much delayed (three years after the injury), the combined orthodontic and periodontal approach made it possible to achieve successful correction through slow maxillary expansion, derotation using a 2×4 appliance, and soft tissue surgeries including supracrestal fiberotomy, frenectomy, and vestibuloplasty. The clinical problem faced was the presence of dense fibrous tissue and an aberrant frenum attachment, which were surgically managed to prevent relapse and improve function. Overall, the treatment resulted in satisfactory esthetic, functional, and psychological rehabilitation.

ACKNOWLEDGEMENT

The authors acknowledge the Department of Orthodontics and Dentofacial Orthopaedics and the Department of Periodontics and Oral Implantology, B.P. Koirala Institute of Health Sciences, Dharan, Nepal, for their support in the clinical management of this case.

Conflict of Interest: None.

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