Case Report

A novel spring for correction of ectopically positioned teeth

ABSTRACT

A misaligned tooth can cause serious aesthetic and functional challenges. Customized springs are indeed a practical remedy for aligning such teeth. The skill to provide an ideal system of forces to reach the desired movement, as well as the management of potential side effects, is directly linked to a successful outcome. One such approach is shown in this case report.

Keywords: Biomechanics, ectopic tooth, spring

INTRODUCTION

Facial harmony is directly associated with the presence of a full set of complementary teeth in the dental arch, which are important for stable occlusion. However, ectopically positioned teeth can be one of the factors responsible for the esthetic and functional imbalance. Some etiological factors may justify the retention and/or impaction of the teeth such as genetic factors, atresic arcade, trauma, consequences of systemic diseases, presence of cysts and/or tumors, and long and torturous pathway of eruption. For a correct diagnosis and development of the treatment plan, it is essential to define the tooth location. Thus, it is essential to perform a detailed clinical examination associated with radiographic and/or computed tomography. Clinical signs observed in cases of abnormal path of eruption are prolonged retention of deciduous teeth, delayed eruption of the permanent teeth, absence of vestibular bulging, presence of palatal bulging, and midline deviation. The presence of cysts or tumors is one of the major causes of displacement of the developing tooth bud resulting in an ectopic eruption of the associated tooth with respect to the region involved. The orthodontic treatment should be started as soon as possible to avoid secondary problems. One of the most suitable procedures is orthodontic traction, and its success is directly linked to the management of side effects. Therefore, biomechanical knowledge is required to choose an ideal system of forces for each intended movement.

The Segmented Arch Technique[1] (SAT) consists of the dental arch segmentation for the consolidation of teeth in active units and passive units (anchor), being designed by Burstone *et al*.[1] in 1962. This technique can be applied to the cantilever, which is a device used for dental traction in which a lever arm inserted into a tube (anchorage unit) is connected to an active unit, tied to a free end. To increase system flexibility, helicoids can be made close to the fixed end. The anchor block allows obtaining maximum stability of the posterior segment, which reduces undesirable effects.

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The aim of this novel spring is to correct the ectopically positioned teeth through a cantilever mechanism using SAT concept in order to minimize the side effects and increase the effectiveness of treatment.

SPRING FABRICATION

Spring configuration and steps of fabrication

Armamentarium

Armamentarium required for the spring fabrication included:

- Wire – 0.014AJW
- Loop forming plier, Adams plier, universal plier, and ruler.
- Patients' cast (measurement purposes) and marking pencil.

DETAILS OF FABRICATION

The novel spring was fabricated using 0.014 AJW wire. It consisted of a horizontal arm 6 mm long and a vertical arm 7 mm long with loops of 3 mm internal diameter (to increase the flexibility of the wire.) with a mesial and a distal leg[2] [Figure 4].

SPRING PLACEMENT

Spring was placed next to the upper right central incisor. Mesial leg of the spring was engaged to the ectopically erupted incisor, while the anchor block allowed obtaining maximum stability of the posterior segment reducing undesirable effects.[3]

DISCUSSION

The ectopically positioned teeth cause esthetic and functional problems.[2] Proper planning and execution of orthodontic traction in such cases is extremely important, a thorough knowledge of biomechanics to avoid anticipated side effects is required. Among many strategies cited in the literature to align the ectopically erupted tooth, one is the SAT,[1] consisting of the dental arch segmentation for the consolidation of teeth into an active unit and a passive unit (anchor).

The presented case shows a customized novel spring fabricated for a 13-year-old patient who visited our institution with a complaint of abnormally placed teeth in the upper left front region of the jaw. The patient had a history of surgical removal of a dentigerous cyst in the same region 3 years back. Upper left central and lateral incisors were embedded high in the buccal vestibular area. Extraction of lateral incisor followed by the use of novel spring for correction of ectopically positioned upper left central incisor was carried out.

A 13-year-old patient visited our institution complaining of abnormally placed teeth in the upper left front region of the jaw. The patient's medical and family history was insignificant. She underwent surgical excision of dentigerous cyst in relation to 21, 22, and 23 3 years back. Clinical examination showed symmetrical and proportional face, straight and harmonious profile, competent lips, and suitable smile line [Figure 1]. Intraoral examination showed mixed dentition Angle's class II malocclusion bilaterally. 21 and 22 were embedded high in the buccal vestibule of the same side. Maxillary midline shifted to left by 3 mm [Figure 1]. Radiographic

Figure 1: Patient's extraoral and intraoral photographs

Figure 2: Patient's lateral cephalogram and orthopantomogram

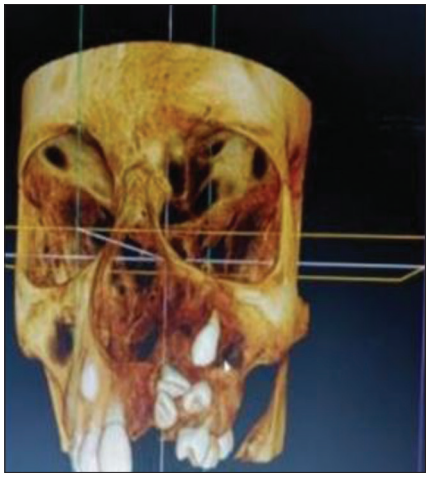

Figure 3: Cone-beam computed tomography image

examination [Figure 2] showed no bony abnormality in the excised area. Orthopantomograph [Figure 2] and CBCT revealed the ectopic position of 21, 22, and impacted 23 [Figure 3].

The proposed treatment prioritized the extraction of lateral incisors as the roots of central and lateral incisors were present in very close proximity to each other. 0.022 × 0.028 inches preadjusted edgewise bracket (MBT) was bonded to the patient. After initial leveling and alignment, the traction was applied to the central incisor with the help of a novel spring after engaging the base archwire 16 × 22 stainless steel wire.

BIOMECHANICS OF THE SPRING

The horizontal spring facilitated the extrusive movement and the vertical spring helped in mesialization. The mesial leg of the spring was preactivated in a vertical direction as well as an antirotation bend was given to facilitate the incisor's derotation [Figure 5].

ACTIVATION SCHEDULE AND TREATMENT PROGRESS

The spring was activated by closing the vertical and horizontal components once every month. The tooth was brought into its desirable position within 5 months [Figure 6a-e].

ADVANTAGES

1. The spring had a low load/deflection rate and applied light-continuous force
2. No adverse effect on the arch form and a low risk of spring deformation
3. The spring had increased flexibility due to added loops
4. Movement of tooth can be limited by activation of loop.

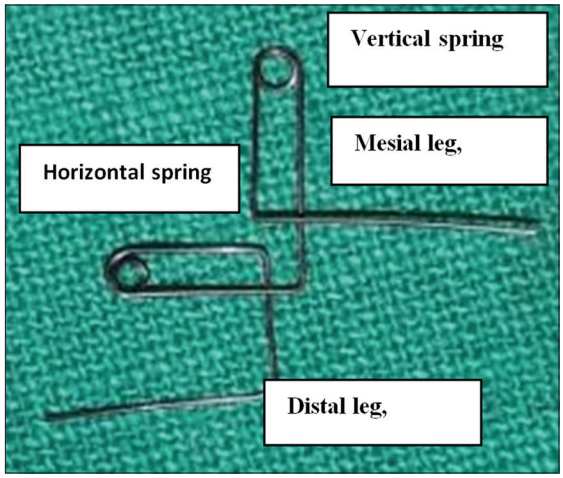

Figure 4: Spring Design

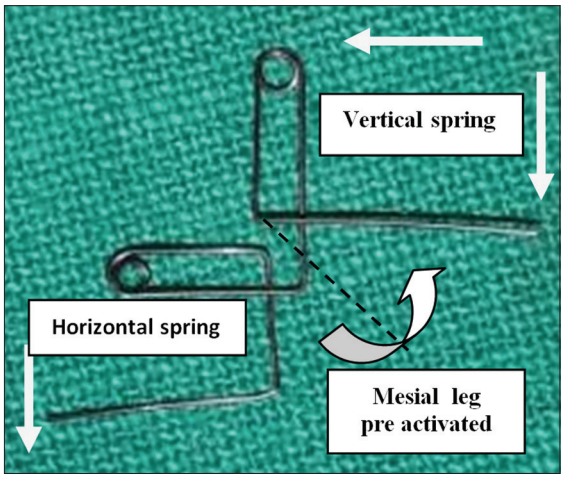

Figure 5: Biomechanics

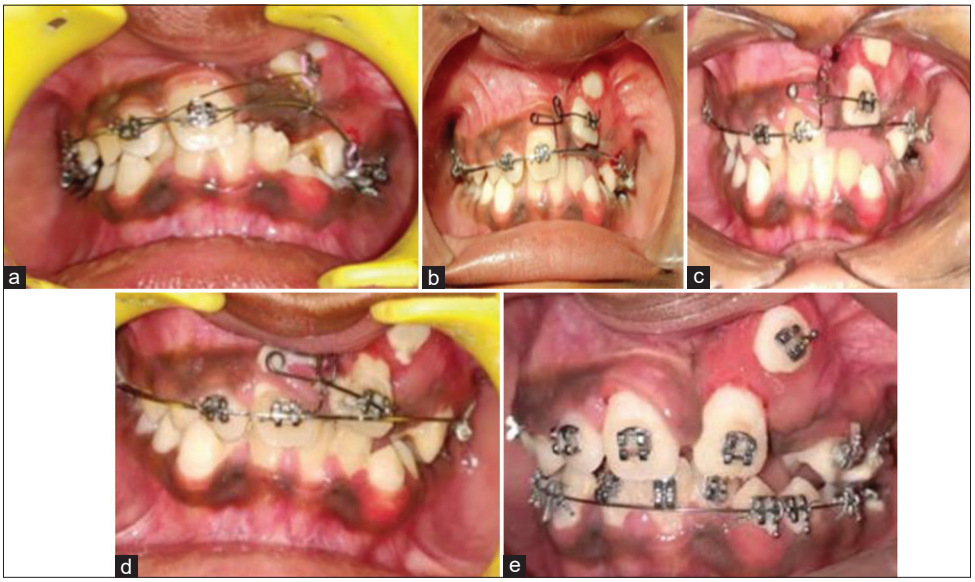

Figure 6: Treatment progress (tooth was brought in place in 5 months). (a) initial stage before spring placement. (b) immediately after spring placement (c) progress in two months (d) progress in four months (e) tooth brought into position

Differential movement of tooth is possible
5. There is precise control over the anterior and posterior anchorage.

The above spring can also be fabricated using AJW wire and TMA wire depending upon the case and desired force level.

DISADVANTAGES

1. The spring is bulky and poses difficulty in oral hygiene maintenance
2. The fabrication is technique sensitive; a thorough knowledge of mechanics is required when using retraction loops or springs, and
3. Spring needs to be reactivated frequently
4. Time consuming – wire-bending skills and chair time are required
5. The spring causes soft tissue irritation; hence, it is uncomfortable in patients with less vestibular depth.

TREATMENT DURATION

The tooth was brought into its position within 5 months.

LIMITATIONS

The spring presented in the study was customized according to the requirement of the case.

This novel spring is yet to be validated by conducting further mechanical testing and clinical trials

Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent forms. In the form the patient(s) has/have given his/her/their consent for his/her/their images and other clinical information to be reported in the journal. The patients understand that their names and initials will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

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Nil.

Conflicts of interest

There are no conflicts of interest.

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