Preprosthetic interceptive orthodontics for missing lateral incisors in late mixed dentition

ABSTRACT

Background Different treatment alternatives are possible in the preprosthetic orthodontic management of missing of lateral incisors. We describe an efficient approach in a 12.11-year-old girl with incisors agenesis.

Case report Treatment started with repositioning of the permanent canines in site 2 and the deciduous canines in site 3. After growth completion the deciduous canines will be extracted and replaced by dental implants. Permanent canines will then undergo reshaping in order to look like lateral incisors. The molar and cuspid relationships were finalised in Class I, with correct overjet and overbite. The mandibular and maxillary arch forms were acceptable without crowding and rotations. Opening the space offers different solutions for maintaining the alveolar bone for a future implant, with the advantage of a molar Class I relationship and a wider arch. It would also be possible to achieve distalisation of the permanent canine, following the Kokich’s principle of alveolar development.

Conclusion The described treatment is a valid alternative in the management of missing lateral incisors. This solution can avoid an additional orthodontic treatment in adulthood and allow easy management of the retention phase prior to final rehabilitation with single tooth implants.

Keywords Interceptive orthodontics; Lateral incisor agenesis; Implants; Missing teeth; Space closure; Space opening.

Introduction

Maxillary lateral incisors are often subject to trauma or agenesis. When one or both teeth are missing, the clinician usually has two options: opening or closing the space(s) of the missing tooth or teeth.

Space opening and subsequent implant placement is considered a treatment to improve dental aesthetics with low relapse tendency and maintenance of the canine protected occlusion [Araújo et al., 2006]. Furthermore implant treatment has some advantages such as tooth structure preservation and alveolar bone maintenance associated with adequate aesthetics and function [Thilander et al., 2001]. However, some negative observations on long-term aesthetic outcome have been recently reported [Zachrisson and Stenvik, 2004]. Since a significant number of patients are adolescents, a comprehensive treatment plan should be discussed, taking into consideration a number of features such as dental asymmetry, facial disharmony and tissue reaction to orthodontic tooth movement.

Age is the main critical factor for timing, placement and position of dental implants. Dentofacial development and the continuous tooth eruption have been the focus of a large number of studies on the infra-positioning of dental implant [Thilander, 2008; Heij et al., 2006; Rasner 2005].

The development of the implant site has to be wisely managed until the adult age in order to warrant a minimum amount of bone loss, the necessary space, a comfortable dental condition, as well as adequate aesthetic and occlusion outcomes [Vitálvos, 2005; Beyer, 2007].

An efficient approach was adopted in the preprosthetic orthodontic management of a 12.11-year-old female patient showing lateral incisors agenesis.

Diagnosis

The patient had a pleasant facial profile with competent lips. Cephalometric analysis showed a skeletal Class I with Class III tendency. Intraoral examination indicated a neutro-occlusion on the right, and a Class I on the left side, deep bite during the late mixed dentition. Several deciduous teeth were still in the arches (upper lateral incisors, upper canines, left lower canine, second molars and lower right lateral incisor). Radiographs revealed the permanent second molars in course of eruption and only the dental germs of the upper third molars.

In the lower anterior area crowding caused the rotation of permanent canine and right lateral incisor compared to their normal position with the deciduous lateral incisor still in the arch.

The mandibular midline was shifted to the right. In the upper anterior arch a median diastema was present (Fig. 1).
**Treatment alternatives**

Therapeutic options are mainly summarised in space closure or space opening of the missing lateral incisors. If space closure was chosen, treatment progress would include the following steps: extraction of the deciduous canines, shifting of the permanent canines in the space of the lateral incisors, subsequent shaping and bleaching of the canines in order to transform them into lateral incisors and transformation of the first premolars into canines. Other possibilities were space opening procedures.

A first space opening option included maintenance of the deciduous lateral incisors for a dental implant to place in adulthood. A retention plate or a Maryland-like template will be used until adult age if the lateral deciduous would fall over the time. This solution could be adopted if the permanent canines would erupt in a distal, but normal position.

A second space opening option aimed at creating a new implant site between teeth 4 and 5. For this option the permanent canine has to be moved in the area of the lateral incisor. At growth completion the deciduous canine will be extracted and the space between teeth 4 and 5 will be created orthodontically. This solution aims to place the implant far from the aesthetic zone.

A third space opening option was to move the permanent canines in site 2 and the deciduous canines in site 3. After growth completion the deciduous canines will be extracted and replaced by dental implants. Shaping of the permanent canines will be performed to transform them in lateral incisors.

**Treatment plan**

After choosing the third space option, the following objectives had to be pursued.

- Correction of the anterior deep bite and achievement of ideal overbite and overjet.
- Achievement of a correct arch form.
- Space maintenance for the missing maxillary lateral incisors.
- Bone preservation for a future implant and porcelain crown.

The treatment plan also had to consider the upper third molar, which should be extracted in adulthood because the lower third molars were missing.

As regards the treatment time, it was decided to begin the therapy before the loss of the lower second deciduous molars in order to take advantage of the Lee-Way space and to early derotate the lower right lateral incisor. Orthodontic therapy established at an early age, like in early or mid-mixed dentition, have proved to be effective in correcting serious discrepancies with good stability over time [Musich and Bush, 2007]. The benefit of an early derotation is a reduced risk of relapse [Vargo et al., 2007; Ferris et al., 2005; Musich and Bush, 2007]. Alternatively a lingual arch could be placed in the mandibular arch to maintain the Lee-Way space, postponing the orthodontic treatment until completion of the permanent dentition, without the benefits of an early derotation.

**Treatment progress**

The initial alignment started with bands on permanent molars, and brackets bonded on the other permanent teeth and on the upper deciduous canines using the Step & Slide system (Leone, Firenze, Italy).

On the right lower permanent canine a bracket was not positioned in order to ensure a better arch elasticity and to avoid excessive bends in the wire which may...
result in an unintended resultant contrary force on the other teeth. This would help primarily the alignment of lower right lateral incisor.

On the upper arch a 014” Australian stainless steel wire was used with omega loop bending against the molar tubes to keep the arch form. On the lower arch a 012” Australian stainless steel wire was inserted with bend backs to avoid detachment of the arch from the molar tubes. Non-conventional low friction ligatures (Leone, Firenze, Italy) were used in order reduce friction. During treatment, the archwires in the upper arch were increased first to 018” and later to 020” Australian stainless steel.

In the lower arch the archwires were increased to 016” and 020” Australian stainless steel. After 6 months the lower right permanent canine was bonded. Then it was derotated with a tie-out tooth movement (named C-tie technique by the author) and with an elastic chain from the canine to the right lateral incisor. All the lower incisors were tied together for anchorage purposes (Fig. 3).

After one year all permanent teeth were bonded, and a 019” X 025” stainless steel arch wire was placed in the lower arch with tie-backs. After the upper canines eruption the final alignment of the upper arch was achieved. Brackets were bonded to permanent canines in the sites of teeth 12 and 22. Then, a 016” NiTi wire was placed with lacebacks followed by a 016”, and a 020” Australian stainless steel wire. The last archwire was a 019” X 025” stainless steel with tie-backs.

**Results**

After 18 months of active treatment, the brackets were debonded, and a fixed retainer was placed in the anterior area of the mandibular arch. The molar and cuspid relationships were finalised in Class I, with correct overjet and overbite. The mandibular and maxillary arch forms were acceptable without crowding and rotations. The periodontal health was maintained.

Contrary to what usually happens, the gingival margin of the canines was too apical compared to the accepted standards. A gingivectomy could improve this feature and give a more esthetic gingival architecture.

The panoramic radiograph showed good roots parallelism and the improved position of the lower second molars. Post-treatment facial and intraoral photographs showed good aesthetic, occlusion and functional results (Fig. 3).
Discussion

Congenital missing laterals are often combined with a median diastema or general spacing, which makes space closure problematic. The midline often shifts to the side of the missing tooth, since the anterior segment does not have the anchorage to oppose a canine and all posterior teeth [Tabuchi et al., 2010]. The canine frequently has a mesial eruption path, which favours its role as a substitute for the missing incisor, after its angulation has been corrected. The mesial position of the permanent canine usually causes an irregular gingival architecture that should be corrected by a slightly incisal reposition of the gingival margin. The canine usually is larger than the lateral incisor, even in its palatal-buccal dimension. Moreover, it usually has a darker yellow colour than the central incisors. The restorative dentist can solve this problem by bleaching or by placing a porcelain veneer or crown to re-create a normal lateral incisor shape and colour [Kokich and Kinzer, 2005].

The recent literature provides several alternatives for treatment of agenesis. Kokich suggests to help the eruption of the permanent canine to the place of the lateral incisor also extracting the lateral deciduous. Otherwise the future implant site will not be created. This way the bone loss after distalisation of the canine is about 1% in 4 years compared to 34% in 5 years after extraction of a maxillary tooth. The Kokich protocol might avoid a regenerative procedure for implant placement [Kinzer and Kokich, 2005].

Every treatment option has advantages and disadvantages. Space closure could be a faster and safer treatment with the exclusion of implant therapy. A Class II molar relationship may arise, requiring a conservative correction of the canine in an high aesthetic zone. When closing spaces due to missing lateral incisors, improper anchorage control can result in narrow dental arches and over-retraction of the anterior teeth. Making already narrow dental arches still narrower could impair facial and dental aesthetics [Sarver, 2001; Sarver and Ackerman, 2003]. Opening the space instead offers different solutions for maintaining the alveolar bone for a future implant, with the advantage of a molar Class I relationship and a wider arch. Placement of an implant (and crown) has the highest success rate of any treatment option and the adjacent teeth are usually unaffected. Implants with smaller diameters have several limitations, since the surface area for bone-implant contact is smaller, with an increased risk of screw loosening, fatigue fracture, and this could reduce the long-term life of the fixture [Mish, 1995]. The one-piece design might reduce the risk of screw loosening and crestal bone loss since there are no abutment screws and no microgap. The primary disadvantage is the requirement for an immediate restoration [Degidi et al., 2009]. The problem about implant placement is that it is not possible to predict the amount of bone loss by the time the patient is fully grown (First space opening option - zone 2), specially in lateral incisor position. Lateral incisors usually have a characteristic gingival contour, with a gingival zenith that is not perpendicular but placed further distally than in canines. Furthermore an implant can cause problems over time such as discoloured labial gingiva, gingival retraction and fixture exposure [Jemt et al., 2006; Thilander, 2008; Heij, 2006; Rasner, 2005]. Posterior site development may solve the aesthetic problems of an implant treatment plan (second space opening option). However in this case the treatment requires a second orthodontic stage and two crown reshaping, increasing the economical and biological expenditure.

The chosen treatment (third space opening option), whose objective was to place the permanent canines in site 2 and the deciduous canines and future implant in site 3, has the advantage to avoid a further orthodontic treatment in adulthood and to place the implant far from the aesthetic risks posed by zone 2.

In the case of a single implant for canine replacement, the literature suggests to avoid creation of excursive contacts on single implant restorations, and it is recommended to create a multiple contact distribution. Decisions must be made about whether to distribute lateral loads over all the working-side contact in group function, how far distally the group function should extend or where the traditional paradigm of anterior guidance should be considered [Kim, 2005].

In this case, only single crowns of the permanent canines could be useful to achieve a better aesthetic result at growth completion.

It would also be possible distalisation of the permanent canine, following the Kokich’s principle of alveolar development. When compared to space closure procedures, this solution has the advantage to maintain the width and perimeter of the maxillary arch. Unfortunately this procedure requires the use of prosthetics crowns when canine colour and shape are unfavourable.

Conclusion

Orthodontic therapy for patients with uni- or bilateral congenitally missing lateral incisors is a challenge for the clinician, who has to plan an effective treatment and prepare the dental arches for the future prosthodontic restoration. Furthermore a successful aesthetic and functional result require a combined multidisciplinary approach, which involves the orthodontist, the oral surgeon, and the restorative dentist. Even if several treatment options are available, the described therapy could be a valid alternative in the management of missing lateral incisors when possible. This solution can avoid an additional orthodontic treatment in adulthood and allow easy management of the retention phase prior to final rehabilitation with single tooth implants.
References


International news

Poland

12th EAPD Congress

Sopot, June 5th–8th, 2014

It’s been already 24 years since the European Academy of Paediatric Dentistry (EAPD) started to organise its bi-annual Congress. It takes only simple math to calculate that the number 12th of this ever growing event will have a really long path to look back upon and a bar lifted extremely high to look forward to. The organisers are inviting to this promising event, presenting all the details together with the program, on their website www.eapd2014.pl.

This well-regarded venue is to be held for the first time in Poland, in the beautiful town of Sopot – the summer capital of Poland, with special attention placed on the newest history of the Polish people. History, that made the town of Tri-City (Gdansk-Sopot-Gdynia) famous worldwide – as the place where the era of communism in Europe started to come to its infamous end. Place, where “Solidarity” movement lead to the end of communist system in all other countries in the region. Congress participants will have the pleasure to dine in the very heart of the place where the “Solidarity” creation process has been commenced. On the other hand, the recreational aspects of Sopot town itself, also called “The Pearl of the Southern Baltic”, are well known by the protractor and edgewise appliances. The region. Congress participants will have the pleasure to take advantage of, particularly in summer. The hotel is located right on the waterfront with its adjacent private beach, with the famous Southern Baltic white sands.

For the first time in history the EAPD Congress will be held in this part of Europe and this creates a unique opportunity for all participants to visit also other parts of Poland which are easily accessible from Hanseatic Gdansk; just to mention a few, Malbork Castle, Zelazowa Wola - Chopin’s house, beautiful Cracow with its Old Town and Royal Castle in Warsaw. According to the Organisers, they are very much looking forward to meeting all Participants in Sopot at the 12th EAPD Congress, to create a perfect place to exchange the scientific knowledge in Paediatric Dentistry, enjoy Polish history and culture as well as preserve and expand social contacts.

Prof. Katarzyna Emerich (Chair of the Organising Committee)