

## **Congenitally Missing Bilateral Incisors with Single-Tooth Implants: Clinical Case**

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**Abstract:** Agenesis, the absence of permanent teeth, is a common occurrence among dental patients. The total incidence of tooth agenesis is about 4.2% among patients that are seeking orthodontic treatment and with the exception of third molars, the maxillary lateral incisors are the most common congenitally missing teeth with about a 2% incidence. Esthetically correcting congenitally missing maxillary lateral incisors is a common challenge that every orthodontist and dental team will face, and dentists must consider the treatment options that are most appropriate for each patient.

This paper describes the therapeutic use of osseointegrated implants to replace congenitally missing upper lateral incisors. Highlighting the importance of the Orthodontic/Restorative interface.

**Keywords:** Tooth agenesis, Lateral incisors, Orthodontics, space closure, dental implants

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### **I. Introduction**

Missing maxillary lateral incisors creates an esthetic problem with specific orthodontic and prosthetic considerations, therefore treatment planning always poses a challenge to the clinicians.[1] The frequency of hypodontia varies, according to different investigators, from 0.27 to 11.0% depending on the methods of registration, grouping of the material and racial differences. The vast majority of cases of agenesis among the permanent teeth involve the second premolars and maxillary lateral incisors. The required amount of space needed for replacing missing lateral incisors is determined by two factors. The first is the esthetics of mesiodistal width between the anterior teeth. Occlusion is the second factor that affects the amount of space that needs to be created .[2,3,4]

The prosthetic options with orthodontic space opening currently available for replacing missing teeth are traditional fixed partial dentures, resin-bonded fixed partial dentures, removable partial dentures and osseointegrated implant supported prostheses[1,5].

Osseointegrated implants are the most biologically conservative and most commonly used option for replacing missing lateral incisors(1,4,5).

When implants are part of the treatment plan, their size dictates the amount of space that needs to be opened. The minimum interdental space needed for a 3.75 mm implant that provides optimal gingival health and sufficient bony support is about 6 mm. Currently, the preferred method for replacement appears to be the implant retained crown following orthodontic treatment. Long-term reliability studies leave little doubt that implant-retained crowns are the most stable long-term restoration available. With current treatment modalities, the replacement can be very esthetic and durable .[1,3,5]

With lateral incisor agenesis and available space, implants are usually the treatment of choice. Implants are a favorable option because no adjacent tooth is prepared for restorations, and implants have a success rate of 90% over 10 years[26]. Pre-implant orthodontics must leave adequate room for the implant between the adjacent roots as well as sufficient crown space. This can be achieved by using the golden proportion, the contralateral lateral incisor, a Bolton analysis, or a diagnostic wax-setup.[6,7,8,9] Generally the lateral incisor site should be 5-7mm. Space between the roots of the adjacent teeth and the implant can be no less 0.75mm, with 1.5-2mm space between the adjacent crowns and implant head .[27] Implants must be placed after growth cessation due to the continuing vertical growth of the jaws. If growth has not stopped, this can lead to infraocclusion of the implant with an unesthetic gingival architecture. On average boys finish growth at 21 years of age and girls at 17 years . [1,2,5,10]After orthodontics, the adjacent roots must be maintained out of the edentulous site, and the alveolar ridge may need bone grafting in the future if the ridge narrows. The lateral incisor space will also need a temporary pontic, which is often built into a retainer or a RMB. If the implant is

placed too labially, the thin buccal bone can resorb and the gingiva can appear gray in color. Poor soft tissue management can also lead to loss of papillary esthetics; the papilla distal to the lateral incisor implant can be particularly difficult to fill in the embrasure space.[2,3,6]

**Several criteria have to be considered before placing a single tooth implant in adolescents:**

1. Time of implant placement
2. Development of a proper implant site
3. Space needed coronally
4. Space needed apically
5. Height of gingiva
6. Retention of space needed before implant placement

Generally, implants must not be placed until the patients have completed their facial growth and the majority of their tooth eruption . As the face grows and the mandibular rami lengthen, teeth must erupt to remain in occlusion.[2,8]

However, the implant behaves like an ankylosed tooth and will not follow the changes of the alveolar processes due to the eruption of adjacent teeth.[2,9]

This may result in clinical infraocclusion of the implant-supported crown and cause a discrepancy in the occlusal plane and between the gingival margins of the implant and the adjacent natural teeth .[2,8, 9] Thus, evaluation of the completion of facial growth by cephalometric radiographs must be done and subsequently, the patient should be informed for the optimal time of implant placement .[ 1-10] However, even mature adults can exhibit major vertical steps after anterior restorations with implants to the same extend as adolescents .[1,3,5 ]



**Fig.1a,b,c** ;A patient with missing bilateral maxillary lateral incisors

To achieve a predictable and esthetically satisfying implant outcome, it is crucial to have a properly developed implant site . The buccolingual dimension of the alveolar ridge has to be wide enough to allow a surgeon to place the implant in a correct 3-D position.[ 11,12] If the buccolingual dimension is insufficient, a bone graft may be necessary. An ideal method to develop a proper width of the alveolar ridge can be achieved if the canine erupts next to the central incisor. The buccolingual width of the canine creates a sufficient width of the ridge when erupting.[11-13] After eruption, the canine can be distalized orthodontically and, therefore, establish a proper buccopalatal width of the alveolar ridge. Studies have demonstrated that if an implant site is developed with this kind of orthodontic guided tooth movement, the buccopalatal width remains stable.[14,15] Distalizing may need to be done with bodily movement to develop adequate space between the roots. If a

panoramic radiograph reveals that the permanent canine is apical to the primary canine, the extraction of the primary lateral incisor may be considered to guide the eruption of the permanent canine toward the central incisor.[ 1,2,3, ] This (as explained previously) is favorable for developing a proper implant site. Otherwise, it may not be possible to guide the eruption of the canine near the central incisor, the osseous ridge will not fully develop, and the buccopalatal width will be insufficient for a proper implant placement. In these cases, it is necessary to perform a bone graft before or at the time of implant placement to achieve a sufficient dimension of the alveolar ridge.[1-5]

The amount of space needed for the implant and crown is generally determined by the contralateral lateral incisor. However, if both lateral incisors are missing or the contralateral one is peg-shaped, the amount of space should be determined by one of the methods below:

1. The golden proportion
2. The Bolton analysis
3. A diagnostic wax-up .

Generally, the adequate coronal space should be no less than 6,3 mm where as the interradicular space no less than 5,7 mm [1,5. ] At least, 1 mm between of the implant and adjacent roots is desirable as it is cited that narrower distances between them are more likely to show a reduction in bone height over time . In addition, fixed retention is suggested rather than removable appliances to prevent relapse.[2,7] When the orthodontist opens space for the missing lateral incisor with fixed appliances, he should be very careful so the central incisor and the canine are moved by... and not to tip apart, because this is likely to make implant placement impossible. Thus, the orthodontist must confirm the ideal root position with a periapical or a panoramic radiograph, before the fixed appliances are removed.[10, 15,16] In certain patients, it may be impossible to achieve acceptable interradicular spacing, even though the coronal spacing may be ideal. Particularly, in a patient with a Class III tendency malocclusion who requires proclination of the maxillary central incisors, when the crowns are tipped labially, the roots tend to converge toward each other resulting in a “wagonwheel” effect. In such cases, an alternative restoration option is required .[3,5, 6, 7]

Implants can be placed in women at approximately age 17 and in men at approximately age 21. At these ages, craniofacial growth is generally completed. Treatment of these patients should start before this age because development of the alveolar ridge has to be achieved and coronal space and interradicular space has to be created. That leads to a period of time when space maintenance may have to be provided for a patient, if craniofacial growth is not yet completed. The temporization and stabilization depends on the waiting time until the implant may be placed. If patients are ready for implant placement in a couple of months, a removable retainer, such as a Hawley retainer or an Essix retainer with a built-in prosthetic tooth, can be used. If patients have to wait 1 or 2 years before completion of growth is achieved, a temporary resin-bonded bridge is the more favorable option.[3,5, 8.17,19,20]

#### **Advantages of implant approach;**

- Due to decreased alveolar bone width and increased labial concavity bone grafting may be needed for implant.
- Long-term implant osseointegration
- No need for build-ups of neighboring teeth
- Comparatively short and simple
- Satisfactory short-term esthetics
- Optimal posterior occlusion

#### **Disadvantages of implant approach ;**

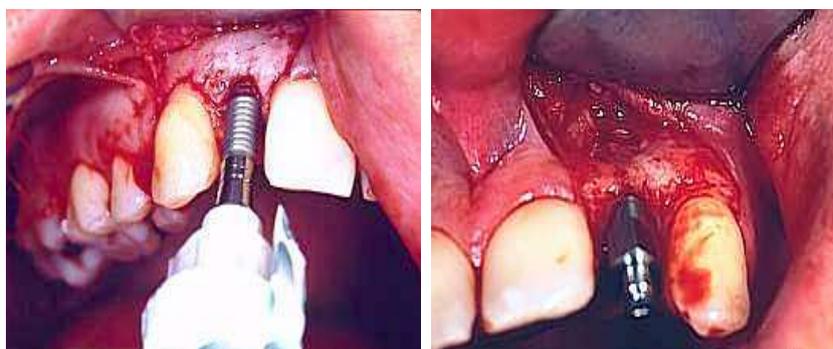
- Progressive infraocclusion
- Visibility of metal or porcelain abutment over time
- Interdental recession (particularly distal papilla)
- Difficulty of making natural-looking porcelain crown

This paper describes the therapeutic use of osseointegrated implants to replace congenitally missing upper lateral incisors. Highlighting the importance of the Orthodontic/Restorative interface.

#### **Case Report**

This case was a 18-year-old female (Figures 1.a,b,c) who had congenital missing of lateral incisors and her chief complaint was missing of the lateral tooth and the diastema. First the space required for implant placement was achieved by orthodontic therapy . To place the implant in a proper position, a bone graft was placed labially to create an adequate ridge width because the tomography showed that the ridge width was

insufficient for implant placement. The donor site was the external oblique ridge site and the lateral aspect of the ascending ramus.



**Fig.2a,b;**A 4.5mm x 8.0mm HA coated implant being inserted into the osteotomy with an implant inserter

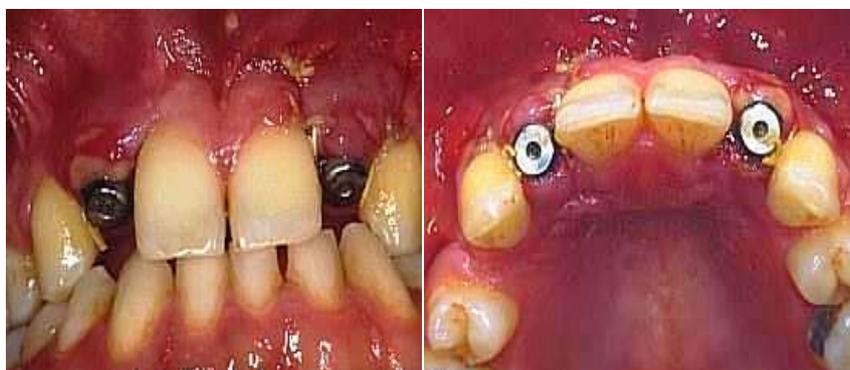


**Fig.2c** Panoramic radiograph of the same patient after bilateral implants insertion.

**A. Surgery** (Figures 2a- c )

Lateral ridge augmentation was carried out using autogenous bone by using a trephine bur and an envelope flap (Trephine Bur Bone Harvest) [ 6,9]

The implant was placed after 6 months . Blocks of grafts from oblique ridge and the lateral aspect of the ascending ramus were harvested and used to create an adequate ridge width anatomy and the collected bone was used as space filler. Six weeks later, one implant with a diameter of 3.8 mm and a length of 10 mm was placed. Six months later, the second stage surgery and aesthetic surgery for leveling of gingival margins were performed and the final restoration was placed.



**Fig.3a,b ;** Two images with healing abutments in place

**B. Restorative** (Figures 3a-b,4,5a-b)

Six weeks after surgery the patient returned for the restorative phase of treatment. The healing abutment on the implant was then modified to create a better emergence profile (1,2,%). This was achieved with air abrasion of the healing abutment, application of metal primer, bonding agent and flowable composite. The desired effect was achieved in that the soft tissue moved in a bucco-apical direction creating a more labial emergence profile. A harmonious gingival contour with the adjacent teeth was established. It was suggested from the outset that a crown lengthening procedure on the peg shaped lateral would create a longer crown length and a more symmetrical gingival contour in relation to the contra-lateral incisor [4,7,8,9,11].



**4Fig.** The screws, connecting them to the implants will be torqued to a pre-determined torque value

The patient decided to keep treatment simple and avoid further surgery and cost [2]. An open tray NC impression coping was connected to the implant and verified radiographically. The 12,22 was minimally prepared for a full coverage veneer. A polyether impression compound was used to take the final impression, taking great care to record the soft tissue emergence profile. The abutments are torqued in, the screw access is sealed off and the porcelain crowns are cemented onto the abutments, much like crowns are cemented onto natural teeth. Below you can see two views of the restored lateral incisors

## **II. Discussion**

The restoration of patients with congenitally missing permanent upper lateral incisors, is a challenge for oral-maxillofacial surgeons as well as for orthodontists and prosthodontists. In this cases an interdisciplinary approach is necessary to provide the most predictable treatment outcome. From early diagnosis till the end of the rehabilitation a number of decisions have to be made. Common issues for multidisciplinary discussions are prophylactic measures, the type of definite prosthodontic therapy, interceptive and extensive orthodontic options , esthetic and functional considerations, dento-alveolar and facial growth patterns, temporary treatment modalities and implant surgery.[1-5]

Diagnostic wax setups allow the prosthodontist the opportunity for input in the treatment planning stage and into final tooth position. During the final stages of the orthodontic care wax setup models also demonstrate e.g. implant site or tooth-size discrepancies. With respect to the aspiration for esthetically optimized results even the necessity for hard and soft tissue augmentation procedures may become visible. Wax setup study models additionally are helpful to involve the patient and his parent in the treatment plan. They show the estimated final occlusion and the possible position of the definite prosthetic tooth replacement.[3,5,16,17,19]

Esthetics as well as occlusion must be considered in the final orthodontic positioning of the teeth adjacent to the edentulous space. To satisfy the "golden proportion" principle of esthetics, the space for the maxillary lateral incisor should be approximately two-thirds of the width of the central incisor.[11,12,13] However, if the patient is missing only one maxillary lateral incisor, the space required to achieve symmetrical esthetics and occlusion is primarily dictated by the width of the contralateral incisor.[19,20]

Implant based oral rehabilitation of patients with congenitally unerupted lateral incisor teeth is one of the most esthetic and predictable procedures within the scope of modern dental practice. While implants have expanded restorative treatment options, treatment planning has become more complex for the dental practitioner and an interdisciplinary team approach is recommended by many authors 3 - 7. Treatment alternatives for restoring edentulous spaces resulting from congenitally missing laterals include removable partial dentures, conventional fixed bridges, resin-bonded bridges, autotransplantation, orthodontic repositioning of canines to close the edentulous space and single-tooth implant.[17-20]



**Fig5a,b** Facial view immediately after the insertion of two Integrated Abutment Crowns

A study by Thilander et al evaluated the long term effect of implants installed in different dental areas in adolescents . [21]The results of the study concluded that dental implants are a good treatment option for replacing missing teeth in adolescents provided that the treatment subjects have completed their dental and skeletal development. The disadvantages of implant placement arising in the lateral incisor region may be due to the slight continuous eruption of the adjacent teeth and craniofacial changes post-adolescence. Shorter the distance between the implant and the adjacent teeth, larger is the reduction in marginal bone levels Hence, orthodontic space gaining and uprighting of the adjacent teeth is a mandatory step prior to implant placement.[1,4,5,17,19,20]

Early investigation and accurate diagnosis are of prime importance especially when there are family histories of congenitally missing teeth, asymmetric loss of primary teeth, over-retention of deciduous lateral incisors and canines, lack of developmental canine bulge or impacted maxillary canine teeth . [22,23,24]In the present case report, there was no contributing family history rendering this patient a first generation sufferer. The optimal time for placement of implants is after growth of the maxilla, mandible and alveolus is complete. If implants are placed before growth is complete, the surrounding alveolar bone may continue to develop vertically and adjacent teeth may continue to erupt. [26,27,28]Thus a discrepancy between the gingival margins of the implant and the natural teeth is created and the implant appears to become submerged, thus creating an esthetic and functional problem .[1,5] If the growth is complete, dental implants can be placed as soon as the edentulous space has been created and the tissues have stabilized following orthodontic treatment . In this case scenario, the patient had reported for the treatment well after the period of growth completion.[1,5]

Congenitally missing lateral incisor presents challenging treatment planning for the dentist as they are usually associated with other malocclusions and abnormalities[29,30]. Selecting the appropriate treatment option depends on the malocclusion, the anterior relationship, specific space requirements and the conditions of the adjacent teeth. In order to obtain the best aesthetic and functional result, a multidisciplinary team approach involving the orthodontist, implantologist and prosthodontist is required.[1,3,30]

Implant supported fixed partial prosthesis is the most conservative way of treatment because of protection of the supported teeth, preventing of the alveolar bone resorption and esthetic outcomes.[8,9] In this case report the patients were evaluated both radiographically and clinically at each appointment. All patients were placed in a recall system comprising periodic clinical, radiographic and hygiene controls. Neither bone nor soft tissue shrinkage was visible at both implant sites.[1-10]

### **III. Conclusion**

Implants are commonly used to replace congenitally missing lateral incisors in orthodontic patients, but the restorations are often challenging because the alveolar crest is too narrow for the implant and may require bone augmentation. When the orthodontist opens the space, the papilla heights are adversely affected, and some patients have altered passive eruption after treatment that affects the level of the gingival margins.

Orthodontists typically limit tooth-reshaping to incisal edge adjustment. However, effective interdisciplinary treatment requires an effective interaction by all the clinicians to achieve an excellent smile. Dentists can control tooth shape by adding or taking away from the tooth, crown, or laminate.

For a successful outcome and patients satisfaction a coordinated orthodontic, prosthodontic, periodontic, and restorative treatments, with careful consideration of patient expectations and requests, are critical. For the replacement of congenitally missing upper lateral incisors implant-supported restorations should represent the treatment of choice.

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