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Case Report

Utilizing the Open Space Approach in Interdisciplinary Management of Bilateral Congenital Lateral Incisor Agenesis: A Case Report

Asma Ben Dalla[1*], Hanen Boukhris[1], Ameni Thabet[1], Sabrine Jlassi[1], Nouha Mghirbi[1], Sihem Hajjaji[1], Hayat Hajjami1, Souha Ben Youssef[2]

[1]Department of Prosthodontics - Faculty of Dental Medicine - LR12SP10 - University of Monastir, BP 56 Avenue Taher Hadded, Monastir 5000, Tunisia
[2]Department of Oral Surgery- Faculty of Dental Medicine - LR12SP10 - University of Monastir, BP 56 Avenue Taher Hadded, Monastir 5000, Tunisia

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Abstract: Tooth agenesis, particularly the bilateral absence of maxillary lateral incisors, is a prevalent condition with notable aesthetic and functional implications. This anomaly, impacting approximately 62% of individuals with genetic predisposition, poses significant challenges in both orthodontics and prosthetic rehabilitation. The treatment of bilateral congenital lateral incisor agenesis is a multidisciplinary approach that requires a thorough clinical examination. Implant-based solutions face challenges due to narrow alveolar dimensions and adjacent root orientations. Successful implant placement often requires pre-treatment orthodontic space creation, ridge augmentation, and careful timing to accommodate continued alveolar growth. Advanced orthodontic techniques and precise implant placement protocols are critical for achieving optimal outcomes. This case report illustrates a time-sequenced interdisciplinary approach combining mesialization of canines with space opening and implant-supported rehabilitation. An interdisciplinary approach, leveraging advancements in orthodontics, implantology, and digital prosthetics, is essential for successful outcomes.

Keywords: Open space/interdisciplinary/Bilateral incisor agenesis/implant.

INTRODUCTION

Management of lateral incisor agenesis is a real challenge and needs a strong collaboration between surgical, aesthetic, and orthodontic dentistry Management of lateral incisor agenesis is a real challenge and needs a strong collaboration between surgical, aesthetic, and orthodontic dentistry Teeth agenesis are frequent and represent significant public health concern with psychological impact during childhood, adolescence, and sometimes adult life. In our clinical practice, especially concerning maxillary lateral incisors, it is a notable aesthetic challenge [1]. The genetics of tooth agenesis has recently been the focus of research. A recent article has demonstrated the involvement of five genes, namely PAX9, EDA, SPRY2, and WNT10A, as risk factors for maxillary lateral incisor agenesis [2].

The bilateral agenesis of maxillary lateral incisors accounts for 62% of this genetic anomaly [3] and leads to aesthetic and functional complications, such as diastemas, smile asymmetry, and mesially positioned canines [4].

Most of the patients receive orthodontic treatment which offers various options: the space may be closed with the canines reshaped to function as lateral incisors, or the space can be preserved or opened for prosthetic replacement, utilizing fixed restorations such as bridges or implant-supported crowns

A very important advantage of opened spaces treatment is to restore canine guidance during lateral movements. But lateral incisors have a crucial role in the anterior guide and an important aesthetic impact, making the prosthetic rehabilitation particularly complex, especially when considering implant-supported options. Implants are increasingly used to replace congenitally missing lateral incisors in young adult patients. However, this area presents significant challenges for implantology due to its narrow dimensions (such as the

***Corresponding Author:** Asma Ben Dalla
Department of Prosthodontics - Faculty of Dental Medicine - LR12SP10 - University of Monastir, BP 56 Avenue Taher Hadded, Monastir 5000, Tunisia

alveolar crest and prosthetic space) and the orientation of adjacent roots. The successful placement of implants often relies on orthodontically created space, and in many cases, ridge augmentation and mucogingival management are required. Additionally, while anterior alveolar growth decreases after adolescence, it continues throughout life. Both animal and clinical studies have indicated that implants do not adapt to this growth, which can result in infraocclusion and aesthetic concerns, particularly in young adults and older patients. This risk is heightened in individuals with a hyperdivergent growth pattern, especially women. Therefore, careful timing and thorough pre-treatment evaluation are essential for achieving successful implant-supported rehabilitation for congenitally missing lateral incisors. Orthodontic treatment plays a crucial role by creating adequate space and optimizing occlusal relationships, facilitating ideal reconstruction outcomes.

This case report is an example of time sequencing interdisciplinary treatment for rehabilitation of bilateral missing lateral incisors with an innovative approach: mesialisation of the canines combined with opened space and implant fixed rehabilitation in lateral incisor area with periodontal tissue management.

CASE REPORT

Patient W.R., a 20-year-old female in overall good health, sought consultation to enhance her smile, which was aesthetically compromised by multiple diastemata (gaps between teeth).

An extraoral examination revealed: a harmonious proportion among the upper, middle, and lower facial thirds. The interpupillary and intercommissural lines were parallel, and the facial profile exhibited a straight contour with slight retrusion. Notably, there was a 5% midline deviation to the right, and her smile displayed a toothy appearance with minimal gum visibility. Examination of the temporomandibular joints indicated no crepitus or clicking.

Subsequently, an intraoral examination was performed, demonstrating good oral hygiene without evidence of periodontal or mucosal pathology. The maxillary labial frenum inserted at the gingival level was not implicated in the maxillary midline diastema.

**In the maxilla, tooth 62 was found to be mobile, and there were no permanent lateral incisors present.

** In the mandible, all teeth were accounted for except for 38 and 48, with no significant crowding or notable diastemata observed.

** Occlusal analysis revealed Class I canine relationships, with right and left molar relationships pending confirmation, alongside normal overjet and overbite measurements.

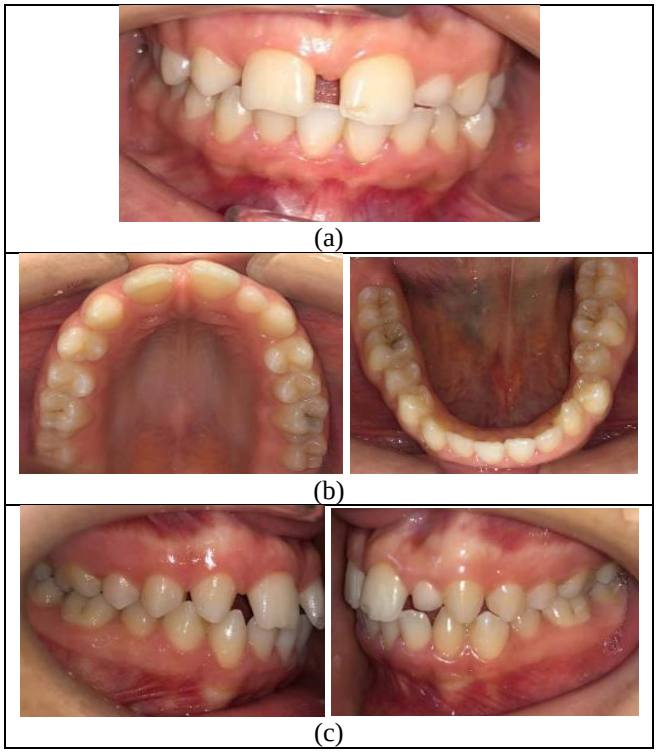
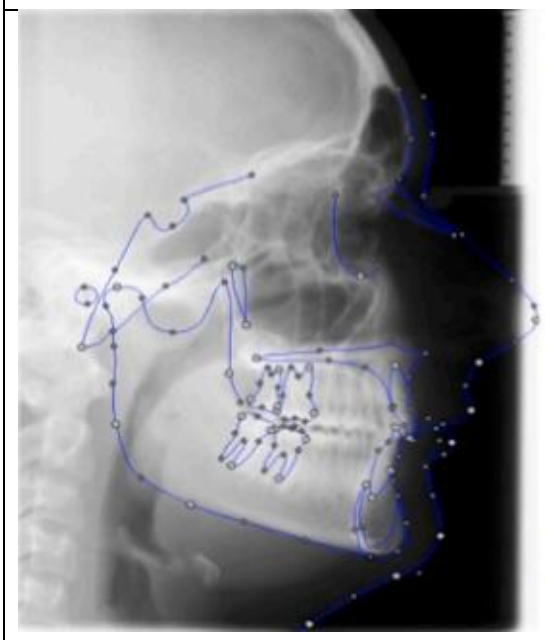


Figure 1: Pre-treatment intraoral reports; 1(a): The maxillary and mandibular arches in maximal intercuspal occlusion; 1(b): Photos of the maxilla and mandible; 1(c): The patient's canine and molar Angle classification (right and left)

Additional diagnostic assessments included a panoramic radiograph (Figure 2), plaster models, and intraoral and facial photographs to document the initial condition and evaluate the most appropriate treatment approach.

(a)



MEASURE	VALUE	MEAN VALUE	DIFFERENCE
SAGITTAL ANALYSIS			
SNA	82.4°	82.0°	+ 0.4°
SNB	79.0°	80.0°	- 1.0°
ANB	3.4°	2.0°	+ 1.4°
AO-BO (Wits)	0.6	0.0	+ 0.6
Facial Angle (PF/NPog)	88.3°	88.7°	- 0.3°
Maxillary Lenght	46.6	57.7	- 11.1
Sellar Angle	120.8°	122.0°	- 1.2°
Cranio-Facial Angle	7.3°	7.0°	+ 0.3°
VERTICAL ANALYSIS			
SN/Go-Gn Angle	27.6°	32.0°	- 4.4°
SN/ASN-PSN Angle	8.1°	10.0°	- 1.9°
ASN-PSN / Occlusal Plane Angle	8.3°	8.0°	+ 0.3°
ASN-PSN/ Mand. Plane Angle	19.4°	20.0°	- 0.6°
N to ASN trought TVL	54.3	54.7	- 0.4
ANS - Gn trought TVL	61.3	68.6	- 7.3
DENTAL ANALYSIS			
Lower Incisor/ Mand. Plane Angle	88.8°	90.0°	- 1.2°
Upper Incisor/ Pal. Plane Angle	98.5°	110.0°	- 11.5°
UI to Palatal Plane	26.1	30.5	- 4.4
U6 to Palatal Plane	19.9°	26.2°	- 6.3°

(b)

Figure 2: Pre-treatment X-ray exams; 2(a): Initial panoramic radiography; 2(b): Initial profile teleradiography / the orthodontic measurement chart

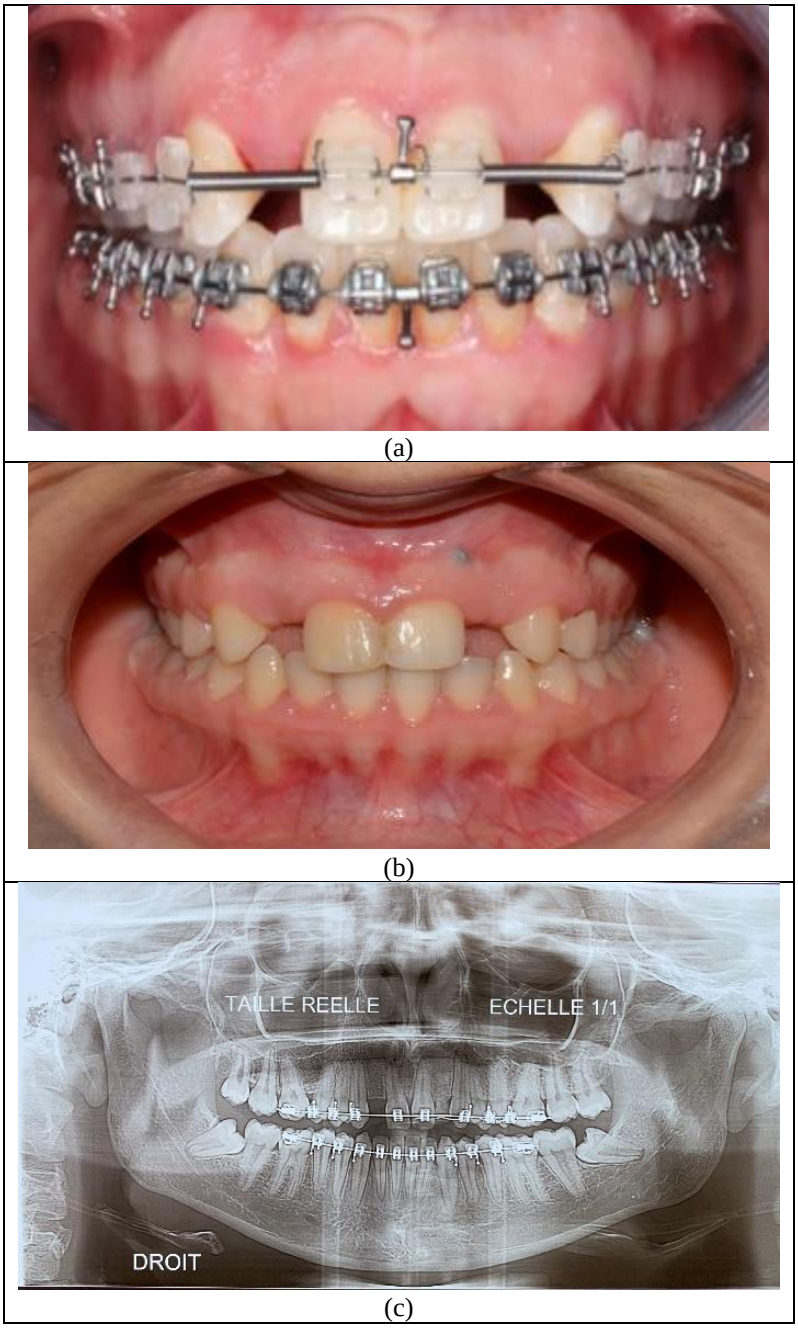
=> Based on the medical history, clinical findings, and supplementary examinations, a diagnosis of maxillary lateral incisor agenesis was established. A collaborative decision was made among the orthodontist, oral surgeon, and prosthodontist to extract the mobile deciduous tooth, underscoring the importance of interdisciplinary teamwork. Following this, plans were made to create the necessary space for the placement of two ceramic supra-implant prostheses.

Phase 1: Orthodontic treatment

The decision to open the spaces prior to prosthetic rehabilitation was made, and at the end of the orthodontic phase, the following outcomes were achieved (Figure 3):

- A Class I canine occlusion with harmonious horizontal and vertical overbites (2 mm) and aligned interincisal midlines.
- Retraction of the canines to make contact with the premolars and closure of the interincisal diastema if present.
- Provision of sufficient space between the canine and central incisor to allow the surgeon to subsequently place the two implants.
- Ensuring that the root axes are verified, with no convergence of the roots present.

After orthodontic treatment was finalized, the orthodontic brackets were removed and a removable appliance was used to replace the missing maxillary lateral incisors.



(a)

(b)

(c)

Figure 3: Post orthodontic treatment; 3(a): Frontal intraoral photograph with orthodontic appliance; 3(b): Frontal intraoral photograph after space opening; 3(c): Panoramic radiography, ongoing orthodontic treatment

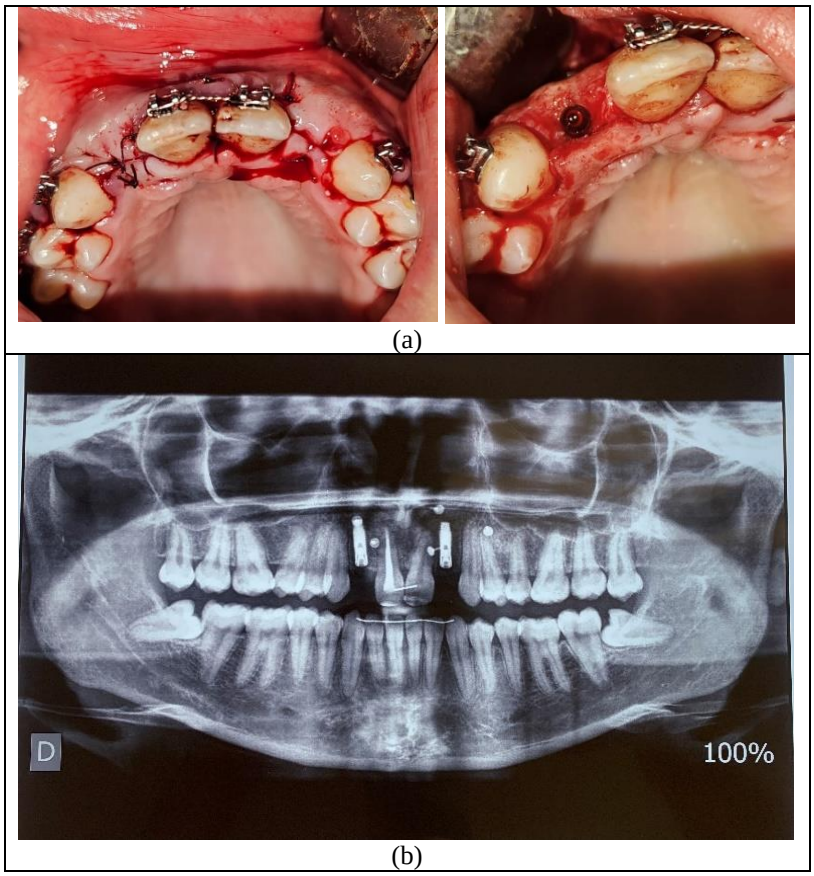
Phase 2: Surgical treatment

A contemporary treatment modality for the management of congenitally absent lateral incisors, which is increasingly endorsed, is the single-tooth implant (Figure 4).

When considering the single-tooth implant as a restorative solution, it is essential to evaluate multiple factors, including growth considerations, spatial requirements, and site development. These elements play a crucial role in ensuring the successful integration and functionality of the implant in the dental arch.

In terms of aesthetics and biology, a minimal space of 1.5 mm must be maintained between an implant and the adjacent tooth. The minimum width required to accommodate an implant in the site of the lateral incisor is 7 mm, allowing for the placement of a narrow-diameter implant (3.5 mm) while maintaining a 1.5 mm space with neighboring teeth. The diameter of the implant ranges from 3 to 4 mm, and the length ranges from 10 to 15 mm: In our clinical situation, the implant used has a diameter of 3 mm and a length of 11.5 mm (3 x 11.5 mm).

Although the spaces designated for the future implants are now ready for placement, the orthodontic device remains active to complete finishing touches, such as closing any potential diastemas that may have developed during treatment and refining the occlusion.



(a)

(b)

Figure 4: Post-surgical treatment; 4(a): Intraoral photograph of the maxilla after implant placement at positions 12 and 22; 4(b): Panoramic radiography after the placement of implants in the lateral sites

=> In conclusion, once the indication for space opening is established, implantology is a reliable therapeutic option with proven long-term success rates for replacing missing teeth. However, while osseointegration is a given, it is no longer an end in itself; the true challenge now lies in the aesthetic and functional integration of the implant-supported superstructure.

Phase 3: Temporization

Following the surgical phase, the temporization stage commences, we used thermoformed splint supporting prosthetic teeth (Essix retainers) as a temporary solution (Figure 5).

Figure 5: Essix retainers supporting prosthetic teeth

Phase 4: Prostheses

After a 2-month osseointegration period, an impression was made using a dual-viscosity silicone impression material (heavy and light body) via an impression transfer technique to fabricate two interim

implant-supported prostheses using polymethyl methacrylate (PMMA) (Figure 6).

After achieving the desired emergence profile with the provisional prosthesis, two ceramic implant-supported crowns were fabricated.

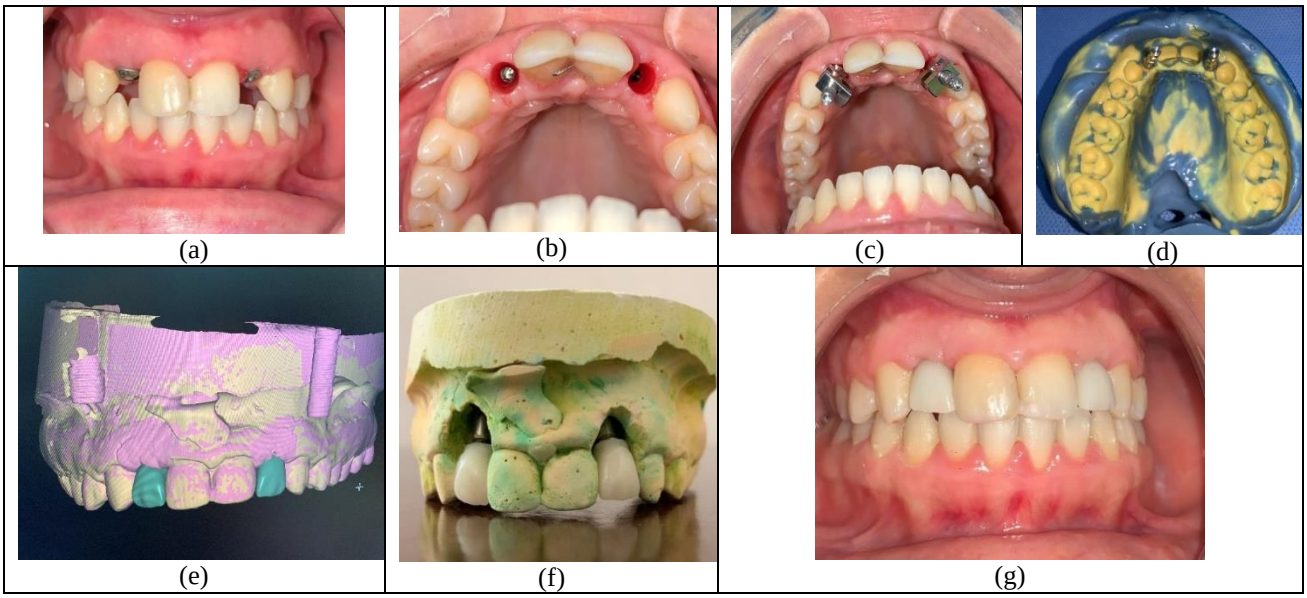


Figure 6: The steps in fabricating the provisional PMMA prosthesis on implants; 6(a): Healing abutments; 6(b): Removal of the healing abutments; 6(c): Placement of implant transfers; 6(d): Impression with double-viscosity silicone (heavy-body + light-body); 6(e): Digital design of the provisional prosthesis; 6(f): Provisional prostheses on the plaster model; 6(g): Fitting and tightening of the provisional prostheses

DISCUSSION

An interdisciplinary approach that engages all team members, including orthodontists, restorative dentists, implantologists, and prosthodontists, is crucial for achieving satisfactory aesthetic and functional outcomes [5].

In cases of congenitally missing maxillary lateral incisors, practitioners have several treatment alternatives [6]:

- Abstaining
- Space Closure by Canine Substitution: One option is to close the edentulous space by orthodontically repositioning the canines to replace the missing lateral incisors.
- Space Opening for Prosthetic Replacement: Alternatively, the space can be preserved or opened orthodontically to allow for prosthetic replacement of the missing lateral incisor. This option may be preferred when:

All treatment approaches have their merits, and the optimal choice depends on several factors**:** the patient's age, oral hygiene, motivation, skeletal class, occlusion, dento-maxillary disharmony, and the number of missing teeth, among others [7].

Space opening for missing laterals is indicated when there is enough space available in the maxillary arch and in the absence of significant bi-alveolar protrusion

On the other hand, if the vestibuloversion of the maxillary incisors is indicated to correct an anterior crossbite or to provide better support for the upper lip, as in cases of cleft lip and palate, space opening is also indicated when there is a Class I molar relationship without dento-maxillary disharmony. The orthodontic treatment aims to maintain or restore posterior occlusion, normalize the incisal overlap and overbite, close the diastema between the central incisors, and distalize the canines to create an adequate pre-prosthetic space for the missing laterals [8, 9].

=> In the context of orthodontics, particularly with advancements in aesthetic dentistry, opening the space is often the preferred strategy. This approach provides several advantages, including enhanced aesthetics through the harmonious development of the facial structure and dentition, improved arch symmetry, and the opportunity for the canine to take its proper position.

Once orthodontic treatment has been completed sufficient space had to be created for future implants:

Recent advancements have significantly enhanced the predictability and long-term success rates of dental implants, establishing them as a preferred restorative option, particularly when the adjacent teeth are healthy, appropriately sized, and free of restorations. Additionally, the placement of an implant can provide functional stimulation, which is beneficial for

maintaining alveolar bone integrity and mitigating resorption.

Due to the functional similarity of an implant to an ankylosed tooth, any vertical growth of the alveolar bone and eruption of adjacent teeth can result in a discrepancy between the gingival margins of the natural tooth and the implant. Consequently, implant placement should be deferred until skeletal growth is complete. It has been suggested that chronological age and hand-wrist radiographs are insufficient for determining growth cessation. Instead, the comparison of superimposed cephalometric radiographs taken at one-year intervals until no further growth changes are observed is recommended.

Moreover, the interradicular space is critical for successful implant placement, often necessitating orthodontic intervention to achieve adequate spacing and proper root angulation. As orthodontic treatment typically occurs at a young age, several years of maintenance therapy may be required before the appropriate time for implant placement. Additionally, maintaining proper spacing is vital for achieving ideal tooth proportions in the final restoration. Beyond the mesiodistal spacing requirements, sufficient buccolingual alveolar width must be ensured for implant placement, frequently requiring an additional surgical procedure for grafting or augmentation of the alveolar ridge prior to implant insertion.

**Implant Positioning in the Mesiodistal Dimension: A minimum interproximal space of 1.5 mm between the implant and an adjacent tooth is necessary. This spacing facilitates the development and maintenance of the interdental papillae based on the vascular supply it allows [10-13].

**Implant Positioning in the Buccolingual Dimension: Ideally, the buccal aspect of the implant platform should be positioned 2 mm or more posterior to a line tangent to the buccal surfaces of the adjacent teeth. Adequate bone width, typically 7 mm or more, is required to accommodate the implant. If insufficient bone is present, augmentation through bone grafting or guided bone regeneration, potentially in combination with a bone substitute material, is indicated [10-13].

**Implant Positioning in the Apicocoronal Dimension: To achieve an optimal esthetic outcome, the implant shoulder should be placed 2 to 4 mm apical to the cementoenamel junction of the adjacent teeth [10-13].

Following the surgical phase, the temporization stage commences, allowing for the osseointegration of the implant. This bone healing period typically lasts up to two months in the maxilla. Various temporization protocols are available, which are primarily influenced by a critical factor at the time of implant placement: primary stability [14].

The choice of an appropriate provisional prosthesis is crucial for the success of the surgical phase and, most importantly, for providing aesthetic comfort to patients.

Guided Bone Regeneration (GBR) procedures, whether performed concurrently with implant placement or not, contraindicate the use of removable prostheses [14], as they can exert trauma on the healing bone and underlying implant. Therefore, a dual temporization approach is recommended [15]:

- A simple thermoplastic splint featuring a commercial tooth at the edentulous site, ensuring no contact with the operated ridge
- After the removal of sutures, a provisional tooth will be bonded between the canine and the incisor, with the splint serving as a backup to address any premature detachment of the provisional restoration

Once osseointegration is achieved, the next phase involves implant activation and adjustment of the peri-implant mucosa. This is marked by the placement of a screw-retained implant-supported provisional restoration, which aids in guiding the healing process, sculpting the emergence profile, and shaping the gingival margin necessary for optimal aesthetics. The emergence profile is designed to have a concave morphology, promoting a thick and stable peri-implant gingival collar [16].

In cases where there is adequate bone volume for immediate implant placement without prior GBR and primary stability exceeds 35 N.cm, immediate aesthetic loading combined with management of the mucosal environment is feasible. An implant-supported provisional restoration will then be fabricated, preferably as a screw-retained unit, positioned without direct occlusal contact, and the patient will be advised to avoid placing stress on it.

Achieving this primary stability of 35 N.cm depends on several factors, including the drilling protocol, implant design, macro and nano topography of the implant, bone quality, and the clinician’s expertise. This accelerated protocol can be implemented as soon as the clinical situation permits. When adhered to strict guidelines, it predictably reduces treatment times, enhances patient comfort, and fulfills the established aesthetic objectives [17].

**Fabrication of the Final Prosthesis

Once bone healing and mucosal maturation are confirmed, the fabrication of the final prosthesis begins. This phase requires careful attention to minimize the number of prosthetic manipulations, as the peri-implant tissue complex remains delicate and cannot withstand

multiple screw removals. Therefore, it is essential for the practitioner to convey as much information as possible to the dental technician to limit the frequency of "screw-ins and screw-outs." This process starts with accurately recording the implant position and the emergence profile shaped by the provisional prosthesis using a custom transfer.

The use of an intraoral scanner, along with various digital tools for shade matching, shape design, and 3D modeling, can significantly streamline this step. This technology enhances communication with the prosthetist and facilitates the fabrication of the prosthetic structure. Zirconia has emerged as the preferred material for these implant restorations, demonstrating effectiveness in both aesthetic and mechanical properties, as well as favorable tissue response. Consequently, it allows for the creation of a highly biomimetic restoration.

CONCLUSION

The interdisciplinary management of bilateral congenital lateral incisor agenesis is essential for achieving optimal aesthetic and functional outcomes. Treatment options, including space closure with canine substitution or space opening for prosthetic replacement, must be tailored to the patient's specific needs, considering factors such as age, oral hygiene, and skeletal development.

Space opening for implants is often preferred in modern aesthetic dentistry, providing improved symmetry and proper canine positioning. Advances in dental implantology have enhanced the predictability and long-term success of implants, but careful planning is crucial. This includes ensuring adequate spacing, proper root angulation, and sufficient alveolar bone width.

Following orthodontic treatment, precise implant placement and temporization are key to maintaining aesthetics and comfort. The final prosthesis, often fabricated from zirconia, requires meticulous attention to detail, leveraging digital tools to achieve a biomimetic restoration with minimal manipulation.

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