Implant-prosthetic rehabilitation of an agenesis lateral incisor: a case report and literature review

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Abstract

***Aim*: The aim of this case-report is to describe the clinical results obtained through immediate-load implant rehabilitation combined with orthodontic and prosthetic therapy.**
***Materials and Methods*: A 35-year-old woman went for an initial examination to the Department of Dentistry and Dental Prosthetics of the Vita-Salute San Raffaele Hospital, directed by Prof. E. F. Gherlone. Intra-oral examination revealed the absence of element 4.2, which was also confirmed by Orthopantomography. Therefore, in order to allow the execution of a correct aesthetic-functional rehabilitation, it was decided to perform a preliminary orthodontic therapy in order to obtain an adequate "upright-ing" for the future implant insertion. Once the optimal space had been achieved, surgical therapy was carried out, involving the insertion of an implant and a subsequent prosthetic crown in stratified zirconia.**
***Results*: Follow-up at 18 months after functional loading showed excellent healing, both radiographically and on objective examination, of the involved tissues.**
Conclusion: Multidisciplinary clinical management, combined with orthodontic and then implant therapy, allowed the achievement of an optimal and lasting prognostic outcome.

Keywords: Agenesis, Etiology, Orthodontics, Dental Implant.

Introduction

Dental agenesis, also known as hypodontia of one or more permanent teeth, is one of the most prevalent developmental anomalies observed in humans [1]. A tooth is considered absent if it has not erupted in the oral cavity and remains invisible upon radiographic examination [2]. While the etiopathogenesis remains incompletely elucidated, evidence points towards a combination of environmental and hereditary factors, possibly interacting to contribute to this condition [3]. Among the affected dental elements, the third molars rank highest, followed by the mandibular second premolars, maxillary lateral incisors, and maxillary second premolars [4].
The agenesis of a permanent tooth can significantly impact occlusion and craniofacial growth, potentially leading to complications such as chewing difficulties, speech impairments, aesthetic concerns, and psychological distress [5]. Though standard definitions may vary, clinical classification typically categorizes patients with agenetic teeth into three groups based on radiographic findings: hypodontia (agenesis of one to five permanent teeth excluding third molars), severe hypodontia or oligodontia (agenesis of six or more permanent teeth excluding third molars), and anodontia (agenesis of all permanent teeth including third molars) [6].
In cases where lateral incisors are absent, implant-supported prostheses emerge as a viable rehabilitation option. Dental implants have become a successful therapeutic alterna-

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tive, even among patients with systemic diseases, which are increasingly prevalent as life expectancy rises [7][8]. While challenges may arise due to insufficient residual bone height hindering the placement of axial implants in the basal bone, whenever feasible, placement in native bone should be prioritized [9].
This case report aims to delineate the clinical outcomes achieved through immediate load implant rehabilitation coupled with orthodontic and prosthetic interventions in a patient with agenesis of the 4.2 elements. Furthermore, the authors underscore the criticality of pre-surgical planning in prosthetic rehabilitation. According to existing literature, selecting fixture type and prosthetic modality can significantly influence short- and long-term implant success [10,11].
All surgical procedures adhered to established standards following the Covid-19 pandemic, aimed at ensuring the safety of patients and staff [12].

Case report

A 35-year-old woman went for an initial examination at the Department of Dentistry and Dental Prosthetics of the Vita-Salute San Raffaele Hospital, directed by Prof. E. F. Gherlone. The patient underwent an anamnestic questionnaire from which it emerged that she was not suffering from any systemic pathology. An intra-oral examination revealed the absence of element 4.2, which was also confirmed by Orthopantomography, a first-level radiographic examination performed during the first visit. Therefore, in agreement with the patient, preliminary orthodontic therapy was decided to allow correct aesthetic-functional rehabilitation and achieve adequate "uprighting" for future implant placement.
Once the optimal space was reached, surgical treatment was carried out, but this was assisted by careful drug therapy:

- Levoxacin: 500 mg once a day for ten days, starting the day before surgery.
- Medrol 0.16 mg: one pill the morning of surgery; three-quarters of a pill the morning after surgery; half a pill two days after surgery; one-quarter of a pill three days after surgery.
- ToraDol drops 20 ml: twenty-five drops as needed.

After all preoperative procedures had been carefully performed, surgery could be scheduled. The surgical phase was performed under local anesthesia (Optocaine 20 mg/ml with adrenaline 1:80,000; Molteni Dental, Florence, Italy). A ridge incision was made with two vertical release incisions; then, a full-thickness flap was lifted from element 4.1 to element 4.3. After preparing the implant site with the appropriate drills, a Winsix TTSI implant of 2.9 mm in diameter and 11 mm in length was inserted (Fig. 1). Finally, the flap was repositioned and adjusted with 4-0 non-absorbable suture (Vicryl; Ethicon, Johnson & Johnson, New B Brunswick, NJ, USA).
Immediately after surgery, the prosthetic phase began, which included the delivery of a provisional prosthesis and the taking of impressions for the fabrication of a definitive prosthesis. The fabrication of the provisional prosthesis was made possible thanks to the insertion of a Winsix Slim 2.9 mm diameter transference that allowed the impression of the arch to be taken. The impression was taken using the pick-up technique and the material used was Impregum (3M Italia, Penta Soft). Subsequently, the immediate provisional was made of acrylic resin (Fig. 2-3). The patient underwent a follow-up examination after one week and the sutures were removed at the same time.
Pending tissue healing and adequate implant osseointegration time, the case was then finalised with a layered zirconia prosthetic reconstruction (Fig. 4).

Figure 1. Implant placement.

Figures 2-3. Insertion of the impression coping and placement of the provisional prosthesis.

Figure 4. Prosthetic finalization.

Follow-up

Follow-up visits, aimed at clinical and radiographic examination, were performed one week after implant placement. Thereafter at three months, six months and then annually until a follow-up of 18 months was reached. The patient was instructed, by a dental hygienist, in mechanical plaque control using an electric or manual toothbrush, interproximal brushes and Super Floss type floss (Oral B, Procter & Gamble, Cincinnati, OH, USA). Whereas, professional oral hygiene procedures were performed every three months following implant placement.

Results

The patient was reassessed at a follow-up of approximately 12 months after functional prosthetic loading. An endoral radiograph was performed to assess the bone quality and the rate of osseointegration of the inserted implant, which were evident radiographically (Fig. 5). A subsequent radiographic follow-up was performed 18 months after functional loading (Fig. 6). Again, the bone quality and osseointegration rate of the implant were excellent.

Discussion

In unilateral agenesis of the anterior sector, a shift of the dental midline, accompanied by displacement of adjacent dental elements into the edentulous space, becomes highly probable, especially if the corresponding deciduous dentition has been lost [13].
The presence of agenesis can lead to significant orthodontic challenges, including alterations in inter-cuspidation, changes in the size and relationships of the bone bases, midline discrepancies, reduction in vertical dimension, extrusion of adjacent teeth due to the absence of antagonists, and aesthetic concerns involving the anterior dental group [14]. Thus, it becomes apparent that the diagnostic phase and subsequent treatment planning, in alignment with the patient's preferences, are paramount, given that therapeutic solutions may encompass various options [15].
Richardson G. and Russel A. suggest that space closure and correction of root proximities may be necessary to create adequate space for implant placement and achieve esthetic restoration [16].
Following sufficient space, dental implants emerge as the most favorable treatment option for replacing missing anterior teeth. Negi A. et al. present a clinical case of

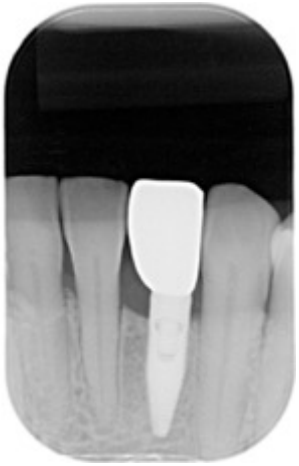

Figure 5. Follow-up intra-oral x-rat at one year.

Figure 6. Follow-up OPT at 18 months.

bilateral agenesis of the maxillary lateral incisors, which was managed through a multidisciplinary approach involving orthodontists, surgeons, and prosthodontists. The authors concluded that space opening and implant-supported prosthesis placement resulted in excellent aesthetic and functional outcomes. Post-treatment, the patient exhibited a well-aligned occlusion, normal overbite and overjet, and satisfactory facial aesthetics [17].

Implants must be positioned to maintain a minimum distance between the implant and natural teeth; indeed, the minimum distance between proximal surfaces should not be less than 1.5 mm, as reported by Tarnow D. et al. [18]. Inadequate spacing may lead to challenges in prosthetic component fitting, compromised oral hygiene, insufficient papillary space, and increased risk of peri-implant bone resorption [19].

Schalk-van der Weide Y et al. demonstrated that single-tooth implants yield excellent long-term results regarding osseointegration and function [20]. However, Krassnig M et al. emphasized the importance of adequate socket thickness for implant placement, mainly when restoring a missing lateral incisor. Evaluation of the width of the edentulous space resulting from orthodontic therapy is also crucial for determining the appropriate implant size [21].

A systematic review by Jung RE et al. reported a five-year survival rate of approximately 97.2% for implants supporting single crowns, with a ten-year survival rate of approximately 95.2% [22].

Lastly, collaboration between the dentist and dental hygienist is imperative to mitigate pre-operative, intra-operative, and post-operative complications [23]. Indeed, meticulous home and professional hygiene maintenance is essential for ensuring implant success [24, 25].

Conclusion

The authors of this case report concur that a multidisciplinary clinical management approach, initially involving orthodontic treatment followed by implant therapy, facilitated the successful rehabilitation of the agenesis tooth element. This comprehensive approach addressed the orthodontic concerns associated with agenesis and provided a framework for achieving optimal and long-lasting prognostic outcomes. By integrating orthodontic intervention to create adequate space and align the dental arches, followed by precise implant placement to restore the missing tooth, the multidisciplinary team ensured a coordinated and synergistic treatment strategy. This collaborative effort restored both function and aesthetics, ultimately enhancing the patient's oral health and well-being. Furthermore, the sequential nature of the treatment approach, with orthodontic preparation preceding implant placement, allowed for proper assessment of the dental and skeletal structures, ensuring optimal conditions for successful implant integration. This staged approach also minimized the risk of complications and maximized the predictability of treatment outcomes. In summary, in this case, the successful rehabilitation of the agenesis tooth element underscores the importance of a multidisciplinary approach combining orthodontic and implant treatment modalities. By leveraging the expertise of various dental specialists, such as orthodontists, surgeons, and prosthodontists, a comprehensive and tailored treatment plan can be devised to meet each patient's unique needs, ultimately resulting in optimal and lasting prognostic results.

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