

Case Report Article

Provisional rehabilitation using temporary anchorage device (mini-implant) in adolescent patients with hypodontia

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Abstract

Introduction: Hypodontia presents a significant challenge when managing dental rehabilitation in adolescent patients. The lack of definitive treatment options during this developmental stage necessitates the exploration of provisional alternatives that provide satisfactory esthetic and functional outcomes. This article aims to showcase a technique for provisional rehabilitation using a temporary anchorage device, specifically a mini-implant, in the context of hypodontia in adolescents. **Materials and methods:** A 14-year-old patient with hypodontia was selected for this case report. The missing tooth, tooth 12, was replaced with a mini-implant for provisional rehabilitation. The installation procedure and subsequent follow-up evaluations were documented through tomography. **Results:** Imaging follow-up demonstrated a slight reduction in alveolar bone thickness; however, the overall height of the bone remained well-maintained. This finding suggests that the technique employed in this case offers promising results in terms of preserving alveolar bone integrity during the provisional rehabilitation phase. **Conclusion:** The presented technique provides both patient comfort and practicality. Moreover, it offers the added advantage of maintaining alveolar bone height, thus serving as a potential alternative to current rehabilitative interventions. Further research and long-term studies are warranted to validate these findings and establish its efficacy in a larger patient population.

Introduction

Hypodontia, also known as tooth agenesis, is the most common craniofacial malformation in humans and can occur as a part of a syndrome or as an isolated condition [1]. Agenesis of the upper lateral incisors is one of the most prevalent forms of tooth agenesis, with an incidence of approximately 18.2% among permanent teeth, second only to the agenesis of third molars. It is more frequently observed in females and often occurs bilaterally, unlike agenesis in other tooth groups [4, 11].

The absence or loss of anterior teeth can have a significant impact on esthetic perception [9], leading to psychological and social difficulties for affected individuals. This is particularly challenging when the patient is still in childhood or adolescence, as the rehabilitation process becomes more complex [13]. Clinically, the absence of lateral incisors can result in a Bolton discrepancy, as well as changes in tooth inclination, angulation, and the occurrence of diastemas [7].

Among the therapeutic options for growing patients, two main approaches are commonly considered: restorative treatment and replacement of lateral incisors with upper canines. The latter is more suitable for patients with small canines, a favorable facial profile, a Class II dental relationship, and no mandibular crowding [8]. However, this approach often requires invasive orthodontic and restorative procedures, including the adaptation of dental morphology to the patient's occlusal guides due to the morphological differences between canines and lateral incisors. Moreover, anatomical and periodontal aesthetic compromises may arise from differences in color and gingival zenith, leading to poorer aesthetic outcomes perceived by both orthodontists and patients [12].

Among the various restorative options available, removable appliances with prosthetic crowns and bonded pontics are commonly considered. However, these options have drawbacks such as low patient acceptance and compromised aesthetics during eating when the appliance needs to be removed. Another option is implant-supported rehabilitation, which is the ideal choice for patients with single or multiple tooth agenesis. However, this approach is not recommended for adolescents due to ongoing craniofacial and dentoalveolar growth, which can lead to complications such as vestibular bone loss around the implants and marginal bone loss in adjacent teeth [13]. As a result, growing patients often must rely on temporary prosthetic rehabilitations during the growth period while waiting for the appropriate time for implant placement [15].

Orthodontic mini-implants have emerged as a viable option for achieving biomechanical objectives in orthodontics by providing auxiliary anchorage. These self-drilling screws, usually made of titanium alloys or surgical steel, can be used intra- or extra-alveolarly. Previous reports have demonstrated the successful use of mini-implants as a substrate for temporary crowns in cases of tooth agenesis or loss, similar to dental implants. This technique has been utilized in patients with completed growth [10] as well as in growing patients aged between 11 and 16 years as a temporary restorative procedure [2, 3, 10]. Although evidence is limited, a recent literature review supported the validity of this technique for temporary restorations in children and adolescents.

The objective of this study is to report the treatment of a patient with unilateral agenesis of a lateral incisor, including a cone-beam computed tomography follow-up over a period of 5 years, leading to subsequent definitive rehabilitation with a dental implant.

Case report

Patient: ICC, a 7-year-old presenting with anterior open bite and agenesis of tooth 12, sought treatment at a private dental office in Goiânia, GO, Brazil (figure 1).



Figure 1 - The patient initially presented with agenesis of tooth 12 and diastemas on the upper arch

Treatment objectives: The treatment goals were to correct the open bite, create space for tooth 12, and provide temporary rehabilitation during the patient's growth stage. Options such as removable or fixed partial dentures were considered but discarded due to social limitations and the need for tooth preparation. Extraction of the contralateral tooth and replacement with canines

would result in aesthetic and functional issues. Considering the patient's young age, the installation of an osseointegrated implant was not feasible. However, the guardians agreed to explore the use of an orthodontic mini-implant as a temporary solution until the appropriate age for implant placement. Although limited literature was available at the time, it was anticipated that the mini-implant would help maintain bone height and thickness.

Treatment process: The correction of the open bite was performed during the early mixed dentition stage using a palatal crib. The patient was then monitored until the age of 10 to commence treatment with fixed orthodontic appliances. The orthodontic treatment aimed to create space for tooth 12 and achieve root parallelism using Roth Max 0.018" brackets (Morelli, Sorocaba, Brazil) and open NiTi springs (Morelli, Sorocaba, Brazil) for space opening. During the process, some loss of alveolar bone thickness was observed in the region corresponding to tooth 12 (figure 2).



Figure 2 - Final stage of orthodontic treatment featuring a provisional crown on tooth 12

At the age of 14, a 10mm long transmucosal mini-implant with a diameter of 2mm and thickness of 1.5mm (Morelli, Sorocaba, Brazil) was installed, and a temporary acrylic resin crown was fabricated on it (figures 3 and 4). Tomographic follow-ups before and after installation, after a period of 3 years, revealed an increase in alveolar bone thickness and height. A length increase of 2.2mm from the bone crest to the highest point of the maxilla was observed, along with a thickness decrease of 0.3mm at the most apical part of the mini implant (figure 5).

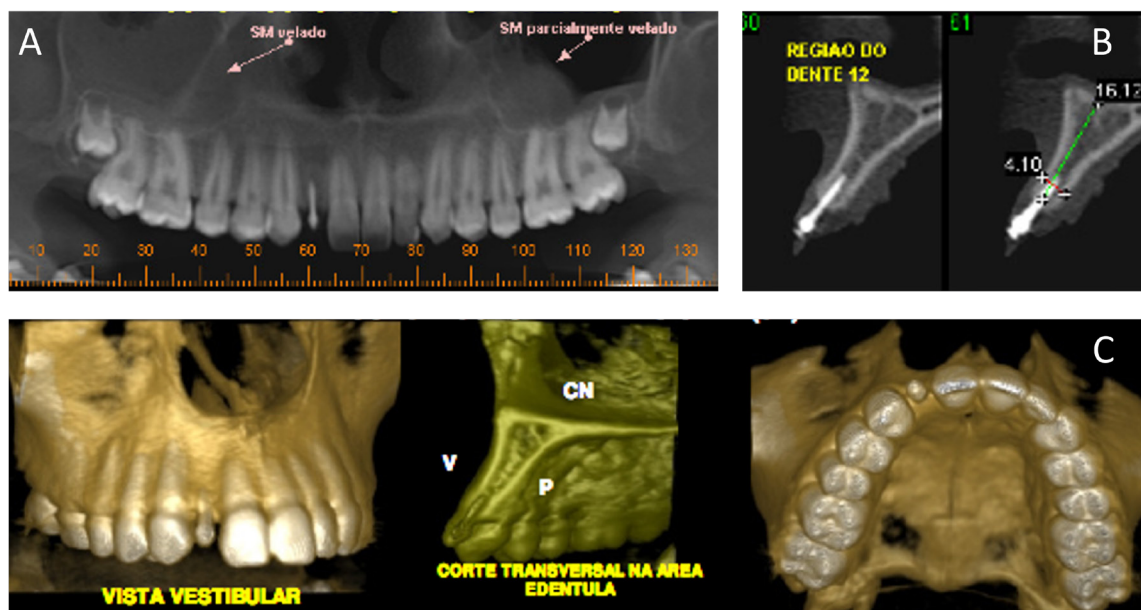


Figure 3 - A 10mm long mini-implant was surgically placed at the site of tooth 12. Precise mesio-distal (A) and vertical (B) dimensions were achieved to ensure an aesthetically pleasing outcome for the provisional crown



Figure 4 - The provisional crown was securely attached to the mini-implant. Strict care was taken to ensure that the tooth did not make occlusal contact during protrusive and lateral excursions, thereby preventing any potential complications or loss of the mini-implant

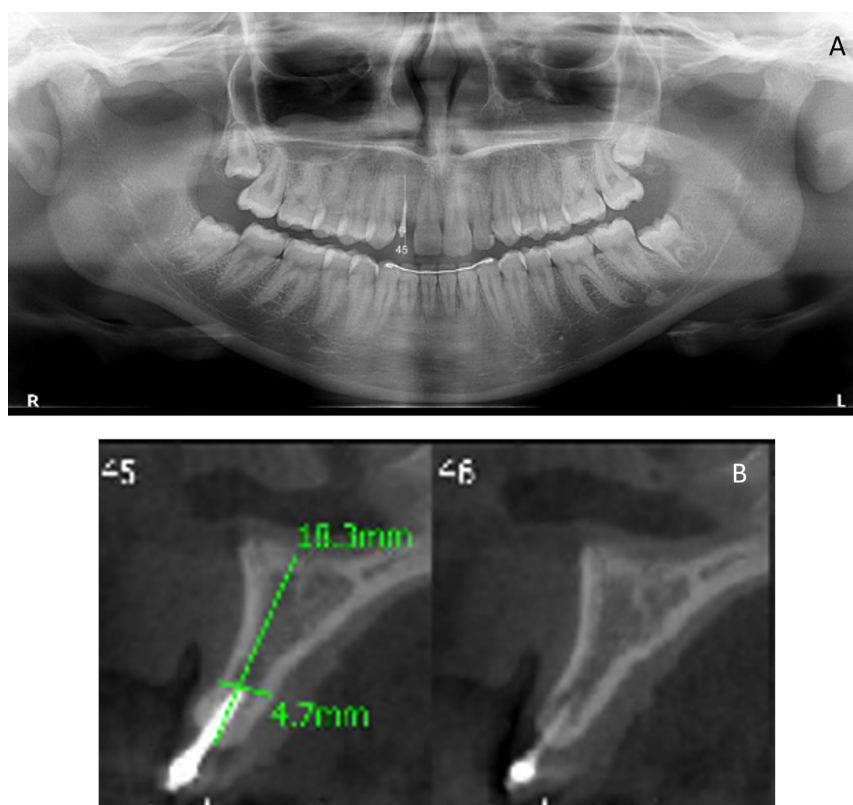


Figure 5 - The mesiodistal dimension was successfully maintained (A). Notably, an increase in alveolar height, possibly attributed to vertical growth of the alveolar bone, was observed during the follow-up period. Conversely, a decrease in width was anticipated due to the absence of a dental root (B)

At the age of 17, the mini-implant was removed. Despite the good gingival conditioning provided by the temporary crown, a connective tissue graft from the palate was performed in the region of tooth 12 to enhance gingival thickness, which was still unsatisfactory (figure 6). Gingival plastic surgery procedures were also performed, and a 3.3mm diameter, 10mm long implant was subsequently installed (figure 7). The final prosthetic rehabilitation achieved satisfactory aesthetic and functional outcomes.

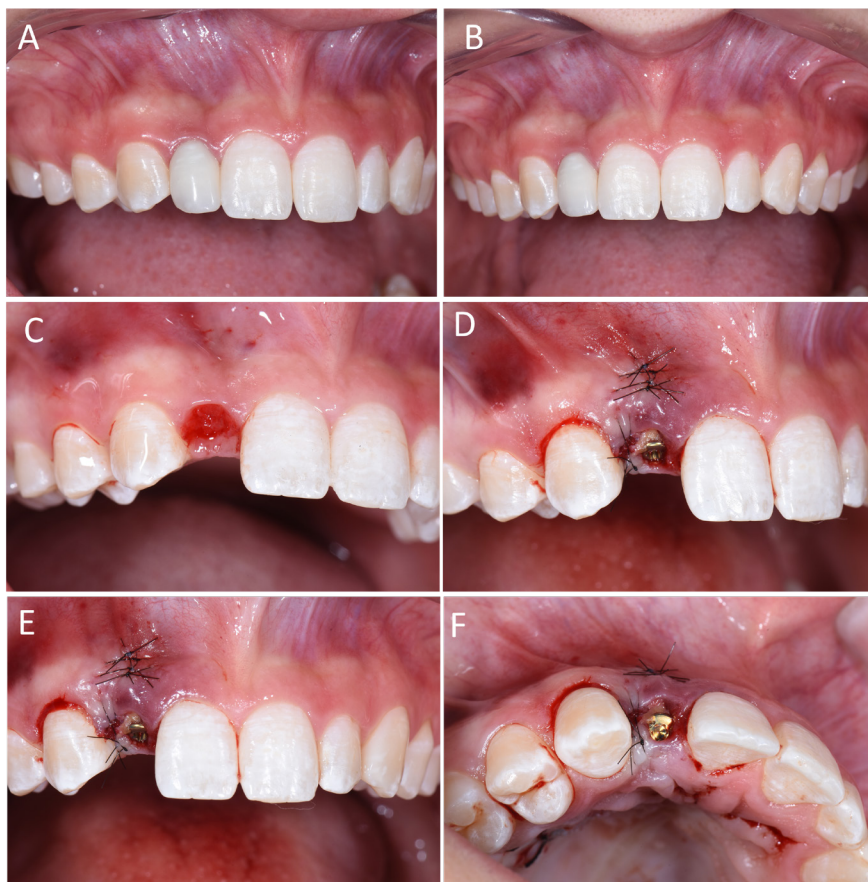


Figure 6 - Despite maintaining a satisfactory gingival profile (A, B), additional measures were taken to optimize gingival thickness by performing a conjunctive tissue graft following site preparation for implant placement (C, D, E, F)



Figure 7 - Completion of the treatment involved successful implant placement and subsequent attachment of a provisional crown. The patient is scheduled for the installation of the definitive crown in a subsequent phase

Discussion

The use of orthodontic mini-implants as a replacement for lost incisors due to dental trauma resulted in the preservation of gingival contour and papilla in an adult patient [6]. Dental implants are the preferred treatment for individual agenesis cases, but their application is limited in growing patients. Craniofacial and dentoalveolar growth can

lead to periodontal changes and malocclusion of the implanted tooth, which would not be reflected in the rehabilitated tooth. Therefore, temporary rehabilitation without the inconveniences and limitations of removable or fixed options involving other teeth is an interesting alternative for clinicians dealing with cases of anterior tooth agenesis [6].

Limited evidence in the literature associates the use of the present technique with the maintenance

of alveolar bone [2, 3, 5, 6, 10]. The use of mini-implants for rehabilitation purposes is not widely reported, and most available studies involve patients aged 14 years and older. Our literature search yielded only one report where mini-implant installation for temporary rehabilitation was performed at such a young age [3].

In our case, the mini-implant remained stable throughout the entire follow-up period. Complications associated with this method were rarely reported in recent reviews, with color alteration and temporary crown wear being the most common issues. Only one report mentioned the loss of the mini-implant one month after installation [5].

The diameter of the mini-implant varies in the literature, with most materials having a thickness of 2mm or 2.2mm [3, 5, 14]. Even devices with smaller thickness used in some studies were successful in installation and follow-up [7]. In our study, the selected material had a thickness of 2mm and demonstrated good stability.

Regarding the length of the temporary anchorage device, successful treatments were reported using lengths ranging from 10mm to 13mm [5, 7, 14]. The only author reporting failure in mini-implant retention used an 8mm long device [5]. However, due to the uncontrolled nature of the studies, causal conditions for this failure cannot be established.

Most studies in the literature relied on two-dimensional imaging for follow-up, which makes it challenging to accurately assess gains in height and impossible to evaluate the thickness of the alveolar bone with the present technique. Our use of cone beam computed tomography scans over a 5-year period demonstrated an increase in both the height and thickness of the alveolar bone. While it is more plausible that this gain was due to the natural growth of the patient, it can be inferred that the present technique did not harm the patient's periodontium, as evidenced by the favorable gingival morphology at the end of the follow-up period.

Conclusion

It is difficult to definitively attribute the increase in alveolar ridge thickness and height solely to the use of the mini-implant in this case, the technique demonstrated positive outcomes. The patient's aesthetics and comfort were improved by avoiding the use of removable or adhesive prostheses, and the technique contributed to the favorable maintenance of periodontal tissues during the period of facial growth. While further research is needed to establish

the long-term effects and efficacy of this approach, the present case report highlights the potential benefits of using orthodontic mini-implants as a temporary rehabilitative option in growing patients with anterior tooth agenesis.

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