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Full mouth rehabilitation of young adults with oligodontia: Two case reports emphasizing implantology, prosthodontics, and restorative intervention

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Abstract

Oligodontia, a severe form of hypodontia characterized by the absence of multiple permanent teeth, presents considerable challenges in dental treatment. Successful management of this condition requires early detection and a comprehensive, multidisciplinary approach. While the complete restoration of missing teeth is typically postponed until all permanent teeth have erupted or after orthodontic therapy, it is crucial to consider additional factors such as the patient's oral hygiene status, socioeconomic circumstances, and long-term maintenance therapy for achieving optimal treatment outcomes. This case reports showcase the effective treatment of oligodontia in two young male patients: a 17-year-old Chinese individual and a 19-year-old Caucasian individual. These cases serve to emphasize the significance of early diagnosis, multidisciplinary collaboration, and personalized treatment planning in addressing the challenges posed by oligodontia. Although orthodontic intervention was not pursued in the presented cases, it is important to recognize its integral role in the overall treatment of oligodontia. The restoration of missing dentition has a profound positive impact on aesthetics, function, and the overall quality of life. The presented cases underscore the importance of early intervention and sustained motivation throughout the treatment process. By emphasizing the value of early detection, comprehensive teamwork, and individualized treatment approaches, clinicians can strive to achieve optimal outcomes for patients with oligodontia.

Keywords: *full mouth rehabilitation, oligodontia, prosthodontics, restorative intervention, severe hypodontia*

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Introduction

Oligodontia is a rare congenital dental anomaly characterised by the absence of more than six permanent teeth excluding the third molar (Chandwani & Suvarna, 2011; Tavajohi-Kermani *et al.*, 2002) The aetiology of oligodontia is multifactorial, involving both genetic and environmental factors. Several genes, such as PAX9, MSX1, and AXIN2, have been associated with the development of permanent tooth agenesis (Der Weide *et al.*, 1994; Mostowska *et al.*, 2005; Zhou *et al.*, 2021). Environmental factors, such as maternal smoking, prenatal exposure to teratogens, and certain medical conditions, may also contribute to the development of oligodontia. The prevalence of oligodontia varies among populations, ranging from 0.08% to 0.33%, with a higher

incidence reported in females (Jepson *et al.*, 2003; Tangade & Batra, 2012). Congenitally absent maxillary lateral incisors, maxillary second premolars, and mandibular central incisors are most often seen in oligodontia cases (Bural *et al.*, 2012; Polder *et al.*, 2004), while the agenesis of maxillary central incisors, maxillary or mandibular canines, or first permanent molars is rare (Dhanrajani & Al Abdulkarim, 2002).

Despite numerous studies indicating the prevalence and distribution of hypodontia throughout the globe, very few studies have reported the prevalence and distribution of this dental anomaly in the Malaysian population. A recent retrospective and cross-sectional study on the prevalence of hypodontia and supernumerary teeth among dental patients was conducted at the Dental Clinic, Advanced Medical and Dental Institute (AMDI), Universiti Sains Malaysia, the tertiary referral centre for Northern Malaysia. The prevalence of hypodontia was reported to be 15.9% and was more prevalent in females (Bahoudela *et al.*, 2022). In addition, they reported that the incidence of hypodontia increased with the subjects' age. The result contradicts the prevalence reported by another study conducted in the central region of Malaysia in 1989, which found that only 2.8% of the Malaysian population had hypodontia (Nik-Hussein, 1989). Despite the fact that both studies only included subjects from specific regions, the results may not reflect the actual prevalence of hypodontia in the entire Malaysian population. The prevalence of hypodontia in Malaysia appears to be high, and dentists are likely to encounter this anomaly in their patients.

The clinical manifestations of oligodontia extend beyond the absence of teeth, often leading to significant functional impairments. The remaining teeth may exhibit space closure, rotation, or supraeruption, resulting in malocclusion and compromised masticatory efficiency. In addition, the absence of multiple teeth can lead to difficulties in chewing, speech articulation, and overall oral function (Bural *et al*., 2012; Der Weide *et al.*, 1994; Dhanrajani & Al Abdulkarim, 2002; Jepson *et al*., 2003; Kotsiomiti *et al*., 2007; Polder *et al*., 2004; Tangade & Batra, 2012). Furthermore, the compromised aesthetics resulting from tooth loss can significantly impact self-esteem and social interactions, leading to psychological distress and decreased quality of life. Therefore, early detection and intervention are crucial to mitigate the negative consequences associated with oligodontia (do Valle *et al.*, 2011).

The dental management of oligodontia requires a multidisciplinary approach involving orthodontists, prosthodontists, oral surgeons, and paediatric dentists. Treatment options include orthodontic interventions to optimize occlusion and align the remaining teeth, prosthetic solutions such as removable or fixed partial dentures, and surgical interventions like dental implants or autogenous grafts for tooth replacement. It must be emphasised that oligodontia generally necessitates lengthy and complex treatments, ranging from multiple restorations to surgical intervention and complex prosthodontic rehabilitation, as well as lifelong maintenance (Demes *et al.,* 2023). Each treatment plan must be tailored to the individual's specific needs, considering their age, skeletal growth, dental development, and functional requirements (Aronovich *et al*., 2022; Bural *et al.*, 2012; Kotsiomiti *et al.*, 2007). Furthermore, when planning the appropriate treatment, the financial implication of the patient must also be considered, as well as providing a long-term oral care to which the patient can comply to (Dhanrajani & Al Abdulkarim, 2002).

This article presents two case reports focusing on the full-mouth rehabilitation of young male adolescents diagnosed with oligodontia, emphasising periodontics, prosthodontics, and implantology interventions. Although the treatment plans for both cases were not the most ideal and unpopular decisions had to be made due to the patients' choice of treatments, the outcome for both cases, considering that they were in a compromised situation, showed a good result and promising long-term stability.

Case 1: Combined periodontics-prosthodontics-oral surgery intervention.

A 17-year-old Chinese young man with severe hypodontia was referred for restorative management. His medical history was not significant, and no family history of any oral or dental anomalies was reported. He was not a regular dental attendee and had no history of dental extractions. Clinical examination revealed a reduced lower facial height, a convex facial profile, a Class II skeletal base with a Class II division 1 malocclusion, a deep overbite, an asymmetrical anterior gingival zenith, and a low smile line. Furthermore, the occlusal plane was slanted in relation to the interpupillary line, and a slight canted and deviated midline was also noted (Figure 1). Oral hygiene and gingival status were good, and no caries were found.

An orthopantomogram (OPG) confirmed that nineteen teeth were congenitally missing: 18, 14, 15, 23, 24, 25, 26, 38, 35, 34, 33, 32, 31, 41, 42, 43, 44, 45, and 48. Six retained deciduous teeth were present: 53, 63, 65, 81, 82, and 83, and significant external root resorption was found in 63, 81, 82, and 83 (Figure 2).

Several treatment alternatives were discussed and evaluated, but the patient declined to undergo orthodontic treatment due to a possible longer treatment duration and additional cost, and as a result, a combination of surgical and restorative therapy was planned. His wishes were to at least have a set of fixed prostheses to function normally while having a set of "teeth" to boost his self-confidence.

A diagnostic wax-up was prepared, and an intraoral mock-up was performed to assess the viability of the proposed treatment plan and get feedback from the patient and his parents prior to the start of the treatment. Due to the poor long-term prognosis of 53, 63, 81, 82, and 83, they were extracted. The remaining retained maxillary left deciduous molar (65) was sound and was used as an abutment for a future bridge.

Two 4-unit provisional fixed-fixed bridges were constructed on abutments 13, 12, 22, and 65. This was followed by surgical crown lengthening to improve the position of the gingival zenith and gingival aesthetic. Before the surgical procedure, a cone beam computed tomography (CBCT) was taken, and the dimension of the labial crestal bone to the cementoenamel junction (CEJ) was analysed to determine the amount of crestal bone to remove during ostectomy (Figure 3). In the mandibular arch, six Nobel Active® (Nobel Biocare, Switzerland) implants were placed between the first molars, followed by a temporary removable partial denture. After a healing period of 6 months, the mandibular implants were restored with three segmented cement-retained full zirconia bridges on customised titanium abutments (Figure 4). Although the authors prefer screw-retained prostheses, due to the limitation of the bone and thus the non-ideal positioning of implant fixtures during placement, cement-retained prostheses on custom-milled titanium abutments were more favourable for aesthetic outcomes. The authors also took the hygiene and motivation of the patient into consideration before making the decision.

The final prostheses construction for the maxillary arch was initiated after a one-month review of the mandibular prostheses. This was to make sure that the occlusion was stable and the patient was able to function well with the existing provisional bridges. The impression of the provisional prostheses on the maxillary arch was sent to the dental technician as a template to copy for the final prostheses. Two 4-unit porcelain-fused-zirconia (PFZ) bridges for the posterior quadrants and two PFZ crowns for maxillary central incisors were constructed and cemented with dual-cured resin cement (NX3 Nexus™, Kerr Restoratives) (Figure 5). Modified ovate pontics were digitally designed for the prostheses with the gingival convex portion positioned more facially on the residual ridge rather than on the crest. This design provides a better aesthetic appearance while allowing easy hygienic care for long-term maintenance.

The patient was reviewed regularly at 1-week, 1-month, 3-month, and 1-year intervals, followed by annual reviews. The most recent review was a 5-year review in which the peri-implant mucosa and prostheses were stable and the patient expressed positive feedback that he could function very well and was delighted with the outcome (Figure 6).

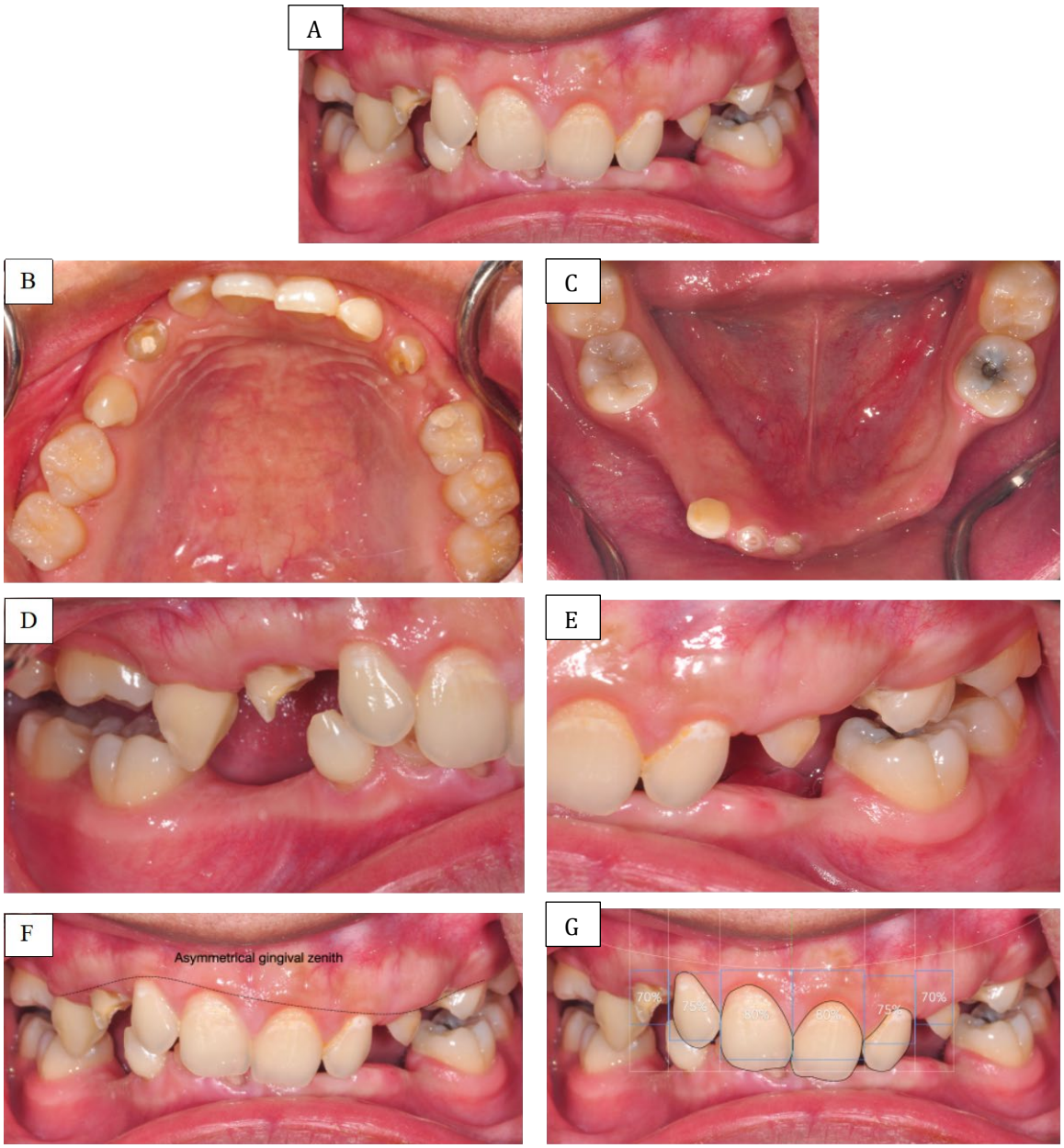

Figure 1. Pre-operative intraoral photographs: (A-E) Pre-operative intraoral view in maximum intercuspation; (F) Asymmetrical gingival zenith; (G) Digital smile analysis to preliminarily assess the amount of tooth reduction and crown lengthening needed.

Figure 2. Orthopantomogram (OPG) to assess the pre-operative oral condition.

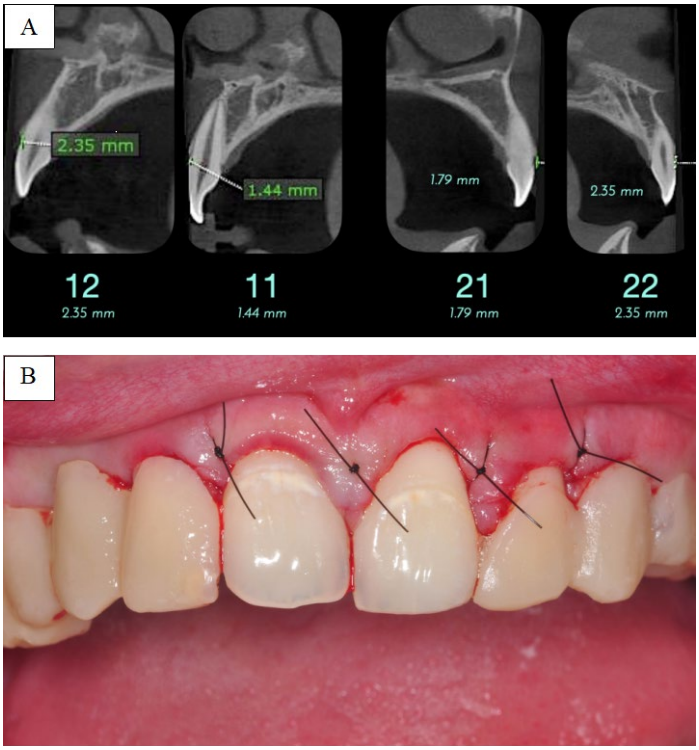

Figure 3. (A) cone beam computed tomography (CBCT) analysis of the dimension of the labial crestal bone to the cementoenamel junction (CEJ); (B) Immediately after surgical crown lengthening.

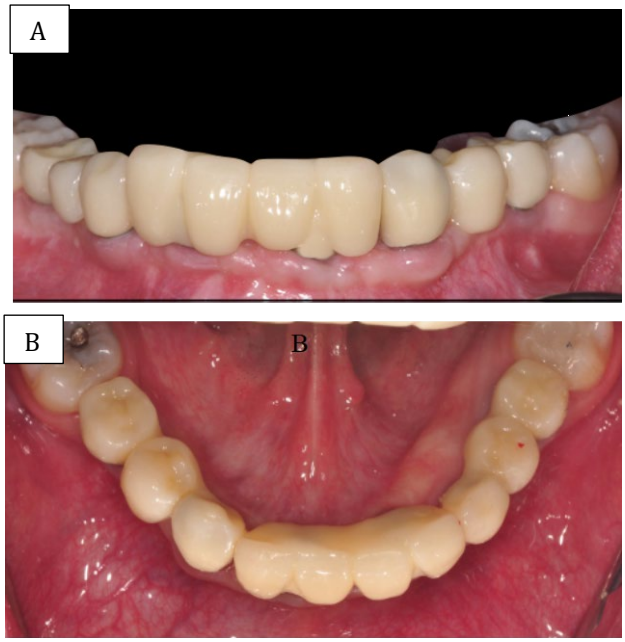

Figure 4. (A, B) Three segmented, cement-retained implant-supported bridges in situ.

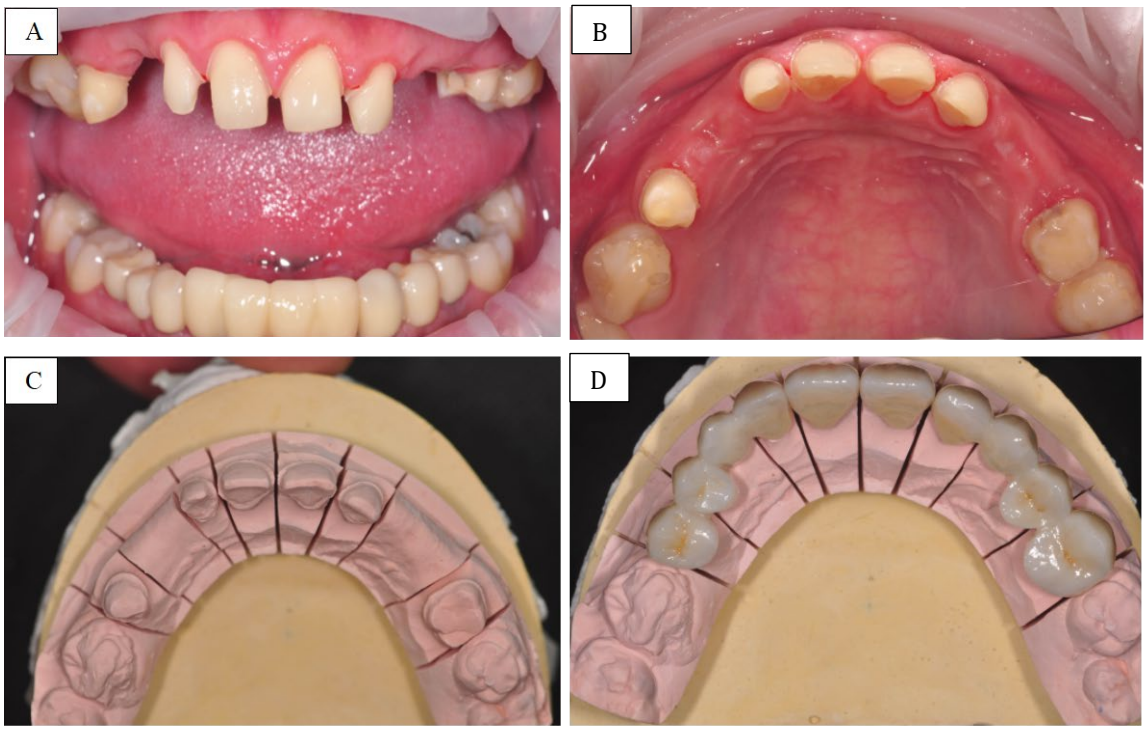

Figure 5.(A, B) Intraoral view of minimal tooth reduction on the maxillary abutment teeth; (C, D) laboratory-milled full zirconia crowns and bridges on master cast; (E-H) Post cementation.

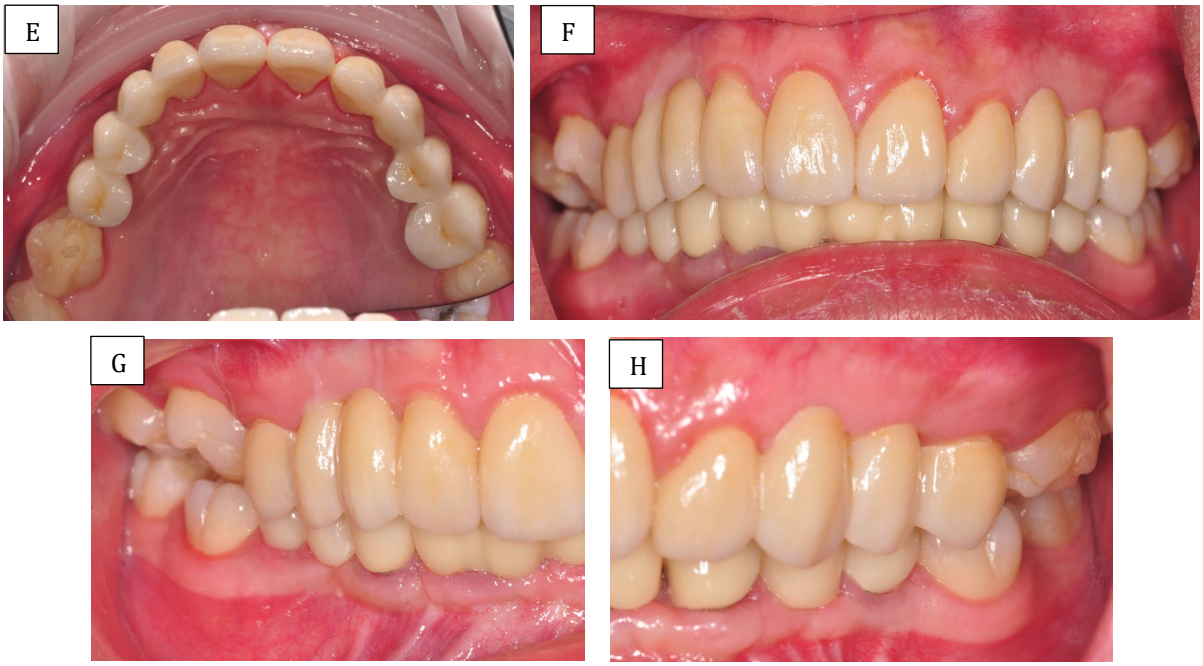

Figure 5. *(continued)*

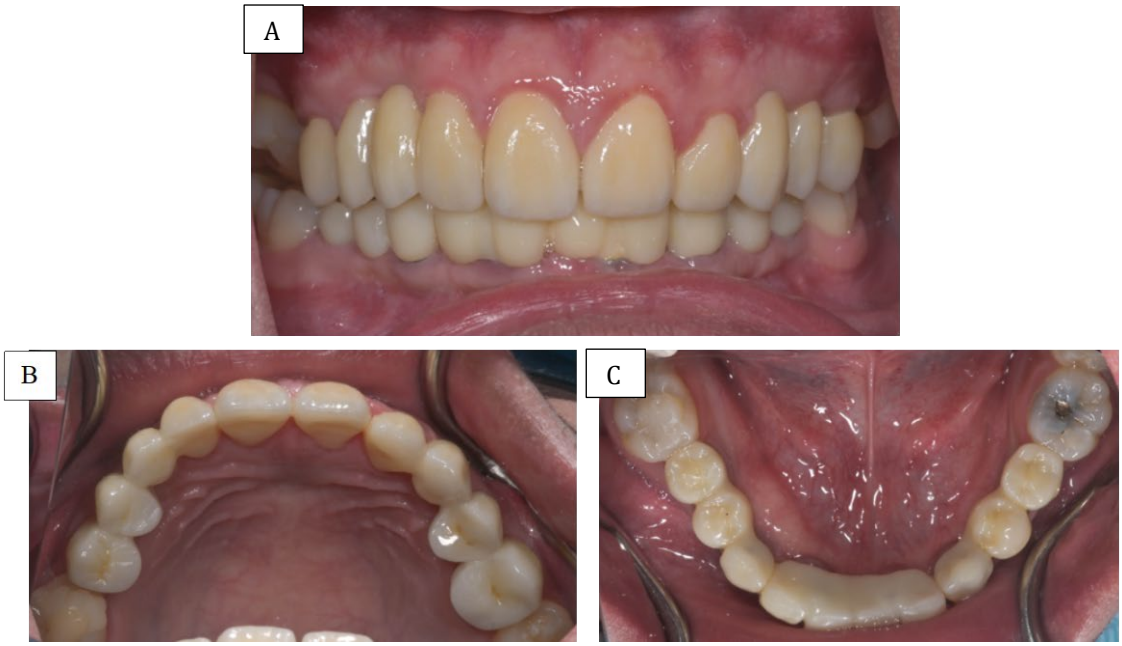

Figure 6. Five-year review. Apart from minimal gingival inflammation around the maxillary crowns and bridges, the peri-implant mucosa and the prostheses were stable.

Case 2: Prosthodontic intervention in a compromised treatment planning

A 19-year-old Caucasian young man with severe hypodontia was referred for the restoration of multiple implant fixtures. The patient had previously undergone unsuccessful removable denture therapy and had rejected orthodontic therapy, in which eight implants were subsequently placed by his oral surgeon. Due to a severe lack of opposing dentition, the patient could not masticate normally and was suffering from social anxiety due to the appearance of his teeth. Since the patient was planning to leave the country soon, he requested to only have the implant restored to help with his mastication and to improve his appearance without prolonging the treatment duration.
Clinically, only nine teeth were present, and eight implant healing abutments were noted (Figure 7). The patient also presented with reduced lower facial height and a deep overbite. Moreover, the interach space for restoration was limited, which was also complicated by constricted maxillary and mandibular arches. The upper midline was shifted about 3mm to the left, and there was a large median diastema with a low smile line. An orthopantomogram (OPG) showed satisfactory implant fixtures in relation to the crestal bone, and no abnormality could be detected on the remaining dentition (Figure 8).

A diagnostic wax-up and intraoral mock-up were performed (Figure 9) to gauge the patient's acceptance of and feedback on the proposed outcome. In the subsequent visit, all the healing abutments, except the one on fixture 44, were replaced with multiunit abutments that were torqued to 35 Ncm in accordance with the manufacturer's recommendation (Figure 9). These multiunit abutments will serve as the final abutments to support the superstructure. Following that, abutment-level impressions and fixture-level impression (implant on 44 site) were taken with polyether (Impregum™, 3M ESPE).

Acrylic jigs were constructed on the master cast, which were later used to verify the passive fit of the definitive abutments intraorally (Figures 10). Once verified, wax rims were used to register the patient's jaw relationship at increased OVD, which was pre-determined at the mock-up stage.

Customised titanium frameworks (AtlantisTM, Dentsply Sirona) were constructed and tried intra-orally to further verify their passive fit, and jaw registration was registered again with the frameworks in situ before the frameworks and bite registration record were sent back to the technician for porcelain layering. (Figure 11) The final prostheses were inserted and torqued according to the manufacturer's recommendation (Figure 12). Modified ovate pontics were constructed for the prostheses with reduced buccolingual width to reduce the size of occlusal table and thus reduce occlusal stresses during function. The convex gingival portion of the ovate pontics were positioned more facially on the residual ridge rather than on the crest to create aesthetically-pleasing appearance as well as better hygienic control for long-term maintenance. A minor occlusal adjustment was performed during the review appointment, but overall, the patient expressed great satisfaction with his appearance, and the outcome definitely boosted his self-confidence and positively improved his social anxiety.

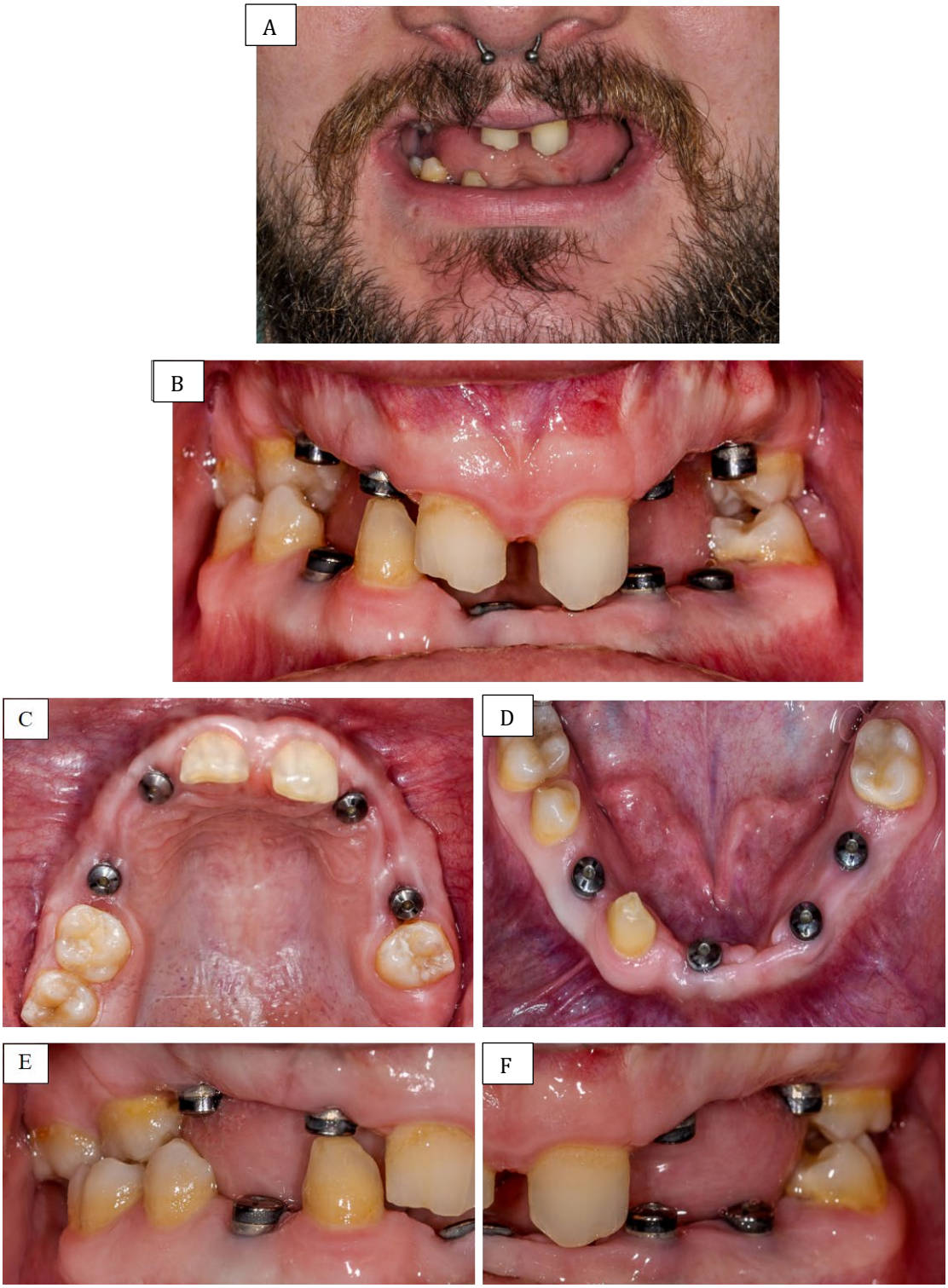

Figure 7. (A-F) Pre-operative extraoral and intraoral view. All implants and healing abutments had been placed by his oral surgeon.

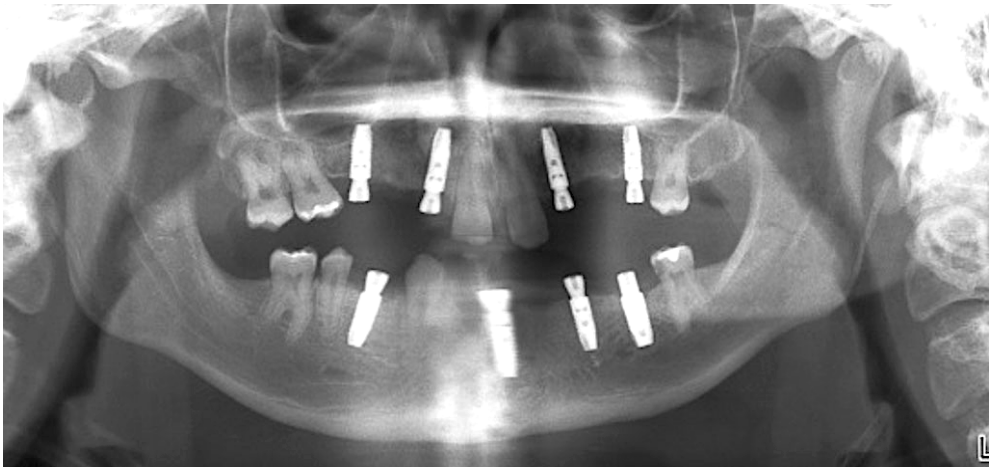

Figure 8. Pre-operative orthopantomogram (OPG) to assess the remaining dentition and the relation of the implant fixtures to the alveolar bone height.

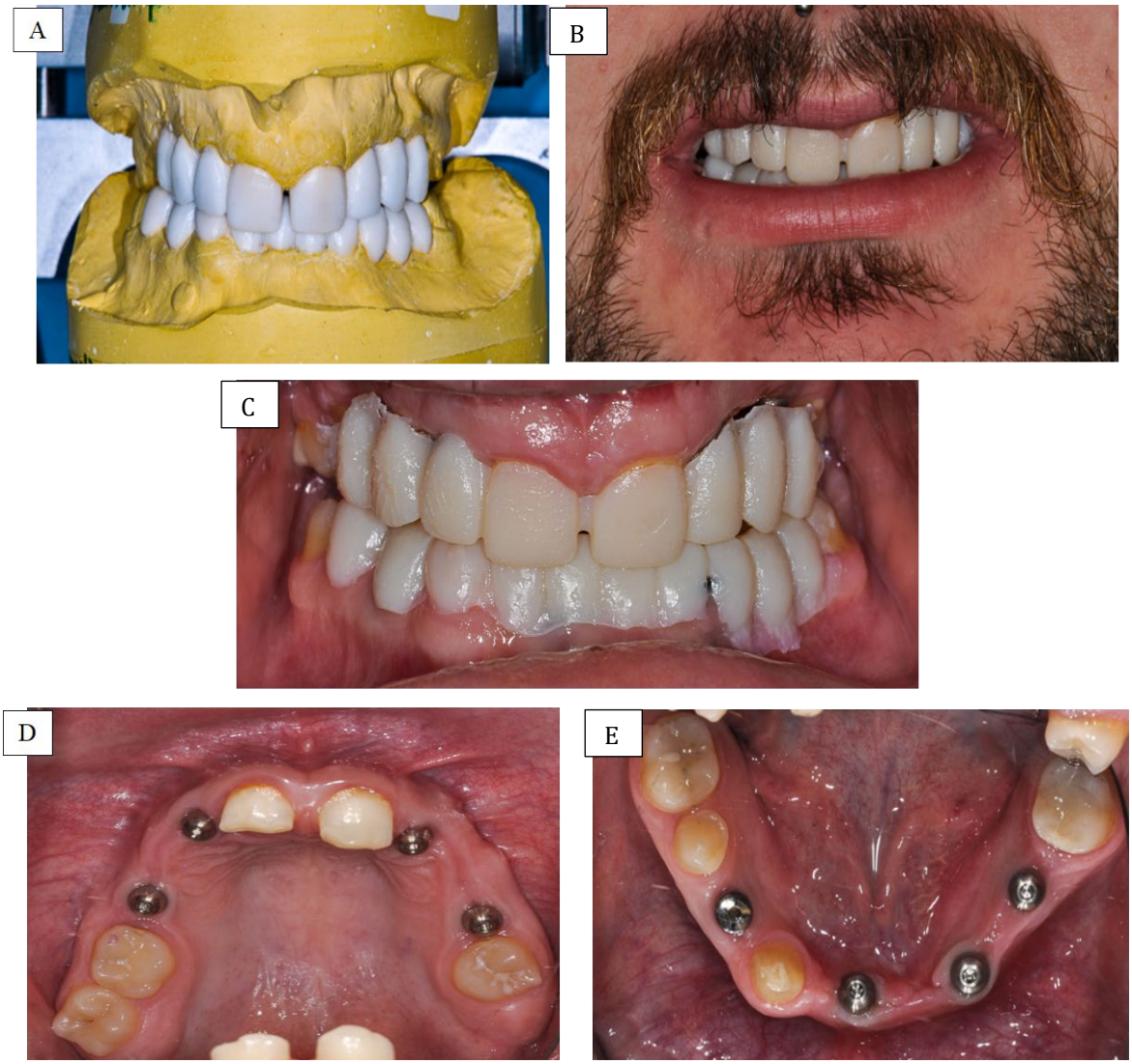

Figure 9. (A) Diagnostic wax up on articulated casts; (B-C) intraoral mock-ups; (D-E) Multiunit abutments were torqued into all fixtures except the fixture on 44.

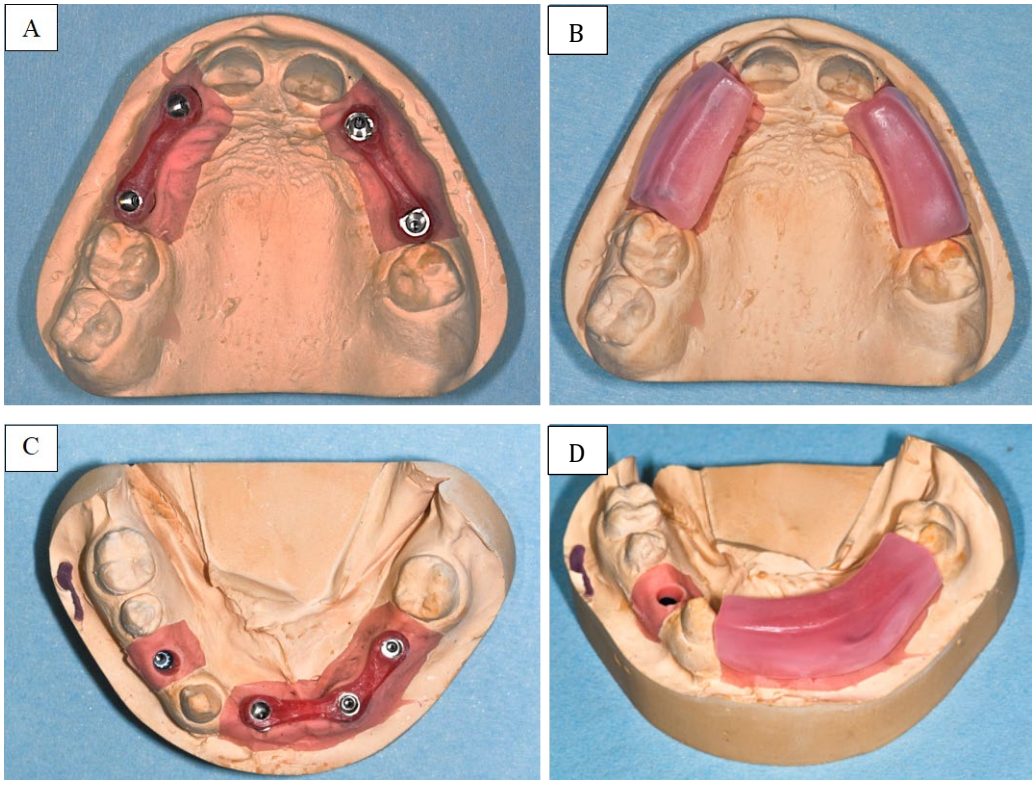

Figure 10. (A-D) Acrylic jigs were constructed on the master casts to allow for assessment of the passive fit of the definitive abutments, followed by wax rims above them to record the jaw relationship.

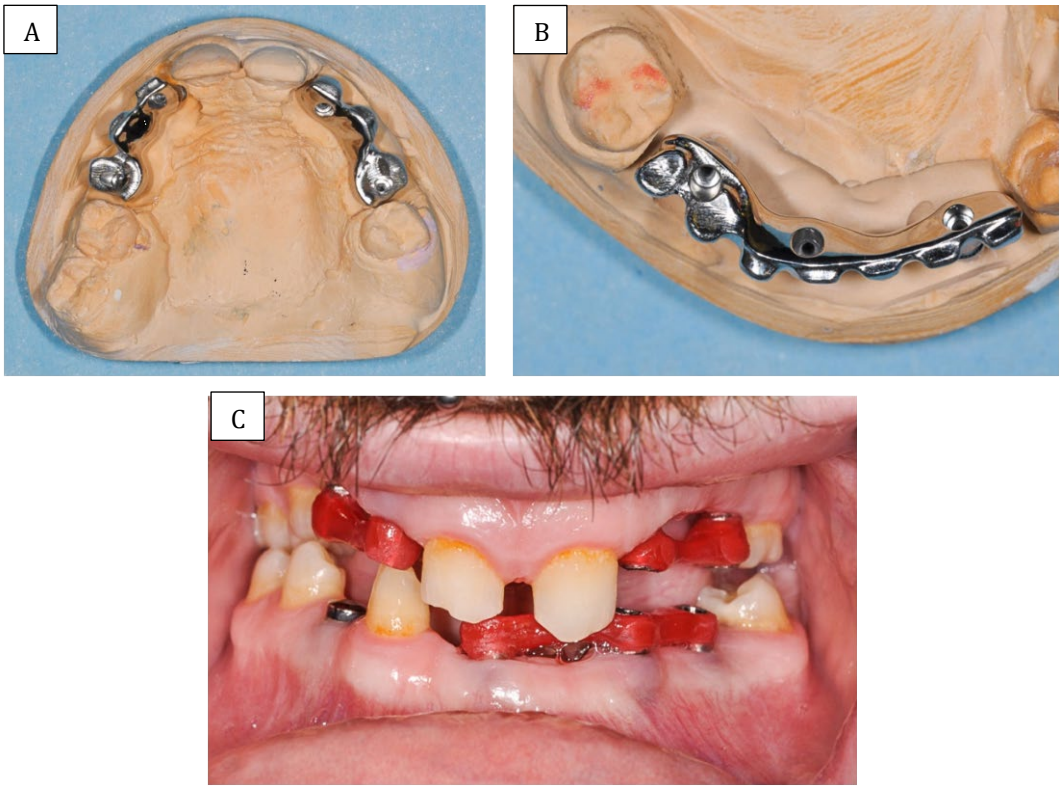

Figure 11. (A-C) Customised titanium frameworks were constructed and tried in intra-orally to further verify their passive fit before jaw registration.

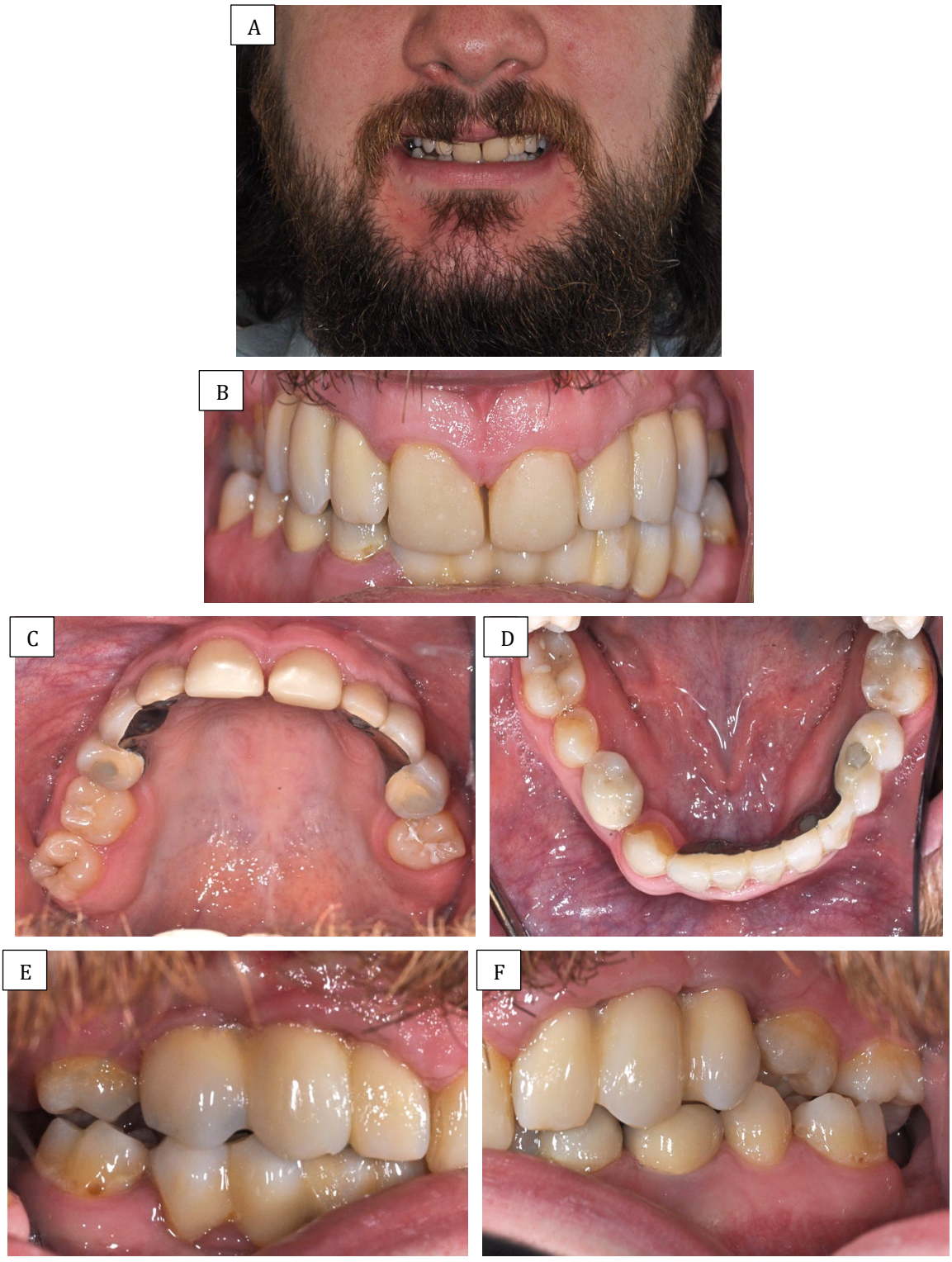

Figure 12. (A-F) Post-operative intraoral view in maximum intercuspation and extraoral view.

Discussion

Both cases highlighted the complexities encountered in managing severe hypodontia or oligodontia, particularly in the absence of orthodontic interventions. Orthodontic tooth movements could have improved the treatment outcomes, such as reducing overbite and closing the midline diastema. The restoration of the occlusal vertical dimension was a significant challenge, and provisional prostheses played a crucial role in monitoring and adapting before the final restorations. The psychological aspect of treatment acceptance and maintenance was also emphasised.

Although there are some similarities to the processes involved in providing fixed prosthodontic treatment, the cases presented the complexities encountered in managing severe hypodontia in adolescents that required highly specific techniques. Not only did the presented cases focus on the clinical and technical aspects of management, but also the inherent psychological aspect that was critical to the patient's acceptance of the prostheses and adherent to their regular maintenance.

Both cases demonstrated the lack of orthodontic intervention, which hampers the more optimal final treatment outcome that can be achieved. Orthodontic tooth movements, especially of the maxillary incisors, were essential to retrude the supra-erupted incisors and reduce the overbite in Case 1 and to close the midline diastema in Case 2. Both cases would have benefited from a more favourable space distribution for subsequent prosthesis construction. Furthermore, loss of occlusal vertical dimension (OVD) is a common manifestation among patients with severe hypodontia, and re-establishing the ideal maxilla-mandibular jaw relationship by means of fixed or removable prostheses is one of the most challenging clinical procedures. Hence, provisional prostheses restored to the planned occlusal vertical dimension are crucial, as this step allows for initial monitoring and adaptation before committing to the final restoration (Marin *et al.*, 2015; Tariq *et al.*, 2021).

The long-term success of oral implants in partly edentulous patients has led other doctors to use implants in younger patients who are missing teeth because of agenesis or trauma. Although removable prostheses have always been the treatment choice for younger patients who are partially edentulous, they are often rejected by the patients. They may also lead to an increased caries rate and residual ridge resorption, as well as periodontal complications (Cronin & Oesterle, 1998; Mankani *et al.*, 2014). Young patients and their parents frequently insist on reducing the treatment duration and opting for implant therapy as soon as feasible due to discomfort from removable prostheses. In the absence of maxillary teeth, the alveolar ridges will not develop, and the maxilla will remain underdeveloped both sagitally and vertically. In contrast, mandibular growth is not dependent on the presence of teeth (Epker, 1998; Shah *et al*., 2013). Therefore, in the presence of hypodontia, the relationship between two jaws will tend to be disproportionate. The pressure to begin implant therapy as soon as possible is further increased by physiological and psychological factors. Additionally, it has been demonstrated that paediatric implants can promote the growth of alveolar bone (Mankani *et al.*, 2014; Shah *et al.*, 2013).

Implant placement in adolescents has long been controversial, with some academics and physicians strongly supporting its use in this patient population while others are totally against it. According to Brugnolo *et al.* (1996), infraocclussion was observed in implants installed in patients aged 13 to 14.5 years due to the vertical growth of the subjects, resulting in the need to re-construct new prostheses. Other studies warned of the possibility of implant loss in the anterior maxilla due to resorption in the infradental fossa and nasal floor (Oesterle *et al.,* 1994; Oesterle, 2000), as well as submergence of implants within the mandibular alveolar process due to a rotational growth pattern (Cronin & Oesterle, 1998). In contrast, Smith *et al.*

(1993) reported that implant use in children with ectodermal dysplasia is a treatment of choice since its placement in the mandibular anterior region of a 5-year-old patient did not affect the adjacent tooth buds; however, they admitted that the prosthesis of their subject needed remodelling due to implant submergence. Similarly, Guckes (1997) found that dental implants placed in the maxilla and mandible had not moved despite growth in a 3-year-old patient with ectodermal dysplasia. Furthermore, a case report by Kearns *et al.* (1999) could not prove the presence of restrictions to transverse and sagittal growth due to implant use in children with ectodermal dysplasia. However, re-construction of new prostheses was necessary in some patients secondary to implant submergence.

In cases of severe anodontia or oligodontia in the mandible, it is possible to place implants before the pubertal growth spurt because few growth changes occur in the anterior region after the age of 5–6 years, owing to the absence of teeth. In contrast, implant placement in the maxilla is advised to be delayed until after growth spurt (Koch, 1996; Graber, 1997). During the 1995 Scandinavian Consensus Conference meeting in Sankoping, Sweden, it was determined that implant placement, particularly in partially edentulous cases, should be delayed until the end of craniofacial and skeletal growth (Koch, 1996).

The anterior mandible holds the greatest potential for early use of dental implant prostheses when compared to the posterior mandible and the maxilla (Fouda, 2020; Op Heij *et al.*, 2003; Shah *et al.*, 2013). Although implants are not routinely recommended for adolescents due to concerns about jaw development, not all adolescents with missing teeth must wait until growth is complete prior to implant placement. This decision should be based not only on growth but also on the number and location of the missing teeth (Sharma & Vargervik, 2006).

The advantages of implant use in adolescents are as significant as the risks associated with their premature use, but they can be beneficial to the growing adult if a meticulous diagnosis and treatment plan are followed. The authors strongly suggest avoiding placing implants in the growing maxilla until early adulthood. This is due to the resorptive aspects of maxillary growth at the nasal floor and the anterior surface of the maxilla, which may cause unpredictable implant dislocations in the vertical and anteroposterior directions. Moreover, the maxilla has a thinner cortical plate and lower bone density than the mandible (Fouda, 2020; Kim & Lee, 2010). Therefore, osseointegrated implants in the maxilla of growing patients must be undertaken with a great deal of caution since anterior maxillary implants were 2.8 times more likely to fail than those placed in the anterior mandible (Mankani *et al.*, 2014). In the mandible, transversal skeletal or alveolodental alterations are less pronounced when compared to the maxilla (Mankani *et al.*, 2014; Oesterle *et al.,* 1994; Skieller *et al.,* 1984). The major portion of the mandible's transverse development occurs early in childhood, while the anteroposterior growth occurs mainly at the posterior mandible. High failure rates in the mandibular posterior region have been determined to be caused by overheating of the bone (Fouda, 2020; Park *et al.,* 2010). However, in children with severe hypodontia, the anterior mandibular growth seems relatively small; therefore, many case reports have shown favourable outcomes and concluded that the anterior mandible represents the most suitable site of implant placement in these subjects (Mankani *et al.,* 2014).

Finding the optimal timing for implant treatment in children or adolescents can be very challenging, as numerous factors must be considered in determining the optimal individual treatment strategy. In view of the evidence from the literature, it is highly recommended to delay implant therapy until the completion of dental and skeletal growth. However, should the need arise and the treatment planning favour implant use before skeletal maturation, the operator should consider the implant location and gender of the patient, and most importantly, the patient and their parents need to be

informed about the benefits, risks, and possible complications of the treatment. In addition, careful attention must be given to the prosthesis design and regular reviews.

Conclusion

The management of oligodontia requires a comprehensive approach that includes early diagnosis, multidisciplinary collaboration, and individualised treatment planning. These elements are crucial in addressing the challenges associated with this condition effectively. When considering implant therapy for patients with severe hypodontia, several factors should be taken into account, such as the implant location, the patient's gender, and skeletal maturation level. These factors play a significant role in determining the optimal timing for implant placement, ensuring favourable outcomes for the patient. The cases presented in this study highlight the significance of various dental disciplines, including implantology, prosthodontics, and restorative intervention. These disciplines work together to achieve both functional and aesthetic results for patients with severe hypodontia. The positive impact of dental restoration on these aspects underscores the importance of early intervention and sustained motivation throughout the treatment process. While orthodontic intervention may be necessary in some cases, the restoration of missing teeth significantly improves aesthetics, function, and overall quality of life. These cases emphasise the importance of timely intervention and ongoing patient motivation in achieving optimal outcomes for individuals with severe hypodontia or oligodontia.

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Conflict of Interest

The authors have no conflicts of interest to declare. We certify that the submission is original work and is not under review at any other publication.

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