Multidisciplinary combined therapy for maxillofacial deformity with congenital missing teeth and insufficient implant space: a case report

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Abstract

Here we present a case of maxillofacial deformity with congenital missing teeth and insufficient implant space. The patient was treated with a multidisciplinary sequence of orthodontics, orthognathic surgery and implant surgery, and has completed implant repair.

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Manuscript

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Implant denture is a method of oral prosthesis developed rapidly in recent years. The design of implant denture is closely related to the anatomical condition of the patient itself. The poor occlusion relationship

and the insufficiency of the repair space will bring speciality to the design and treatment of implant denture repair. Here we present a case of maxillofacial deformity with congenital missing teeth and insufficient implant space. The patient was treated with a multidisciplinary sequence of orthodontics, orthognathic surgery and implant surgery, and has completed implant repair.

Case report

A 19-year-old man who suffered from maxillofacial deformity and poor chewing was referred to the outpatient department in our center. He was subsequently admitted to the inpatient with a diagnosis of the skeletal Angle III malocclusion combined with maxillary dentition defect. The general examination revealed that he had been healthy and well nourished and had experienced no systemic diseases. The detailed clinical examination was as follows: the maxillofacial region was basically symmetrical. 1/3 of the surface, the middle, and the bottom face was approximately 65mm, 65mm, 88mm, respective1y. The length of the upper lip was about 20mm. The orbital plane was basically parallel to the maxillary plane with a slight concave around the nose. From the lateral view, the middle of the face was concave and the nasolabial angle was about 120°. The position of the maxilla was retraction, the position of the mandible was protruding. The maxillary midline was basically centered and the mandibular midline was approximately 2 mm to the right. The reverse overjet of anterior teeth was about 7 mm and the bilateral first molars were the mesioclusion relationship. The congenital missing teeth included tooth 14、tooth 15、tooth 23 and tooth 24(Fig.1). The width of residual alveolar ridge in the absence of teeth was about 3-4 mm. The distance from tooth 14 to tooth 15, tooth 23 to tooth 24 was about 4 mm and 5 mm respectively(Fig.2a). The occlusal distance was normal and the results of cephalometric analysis were as follows: SNA=78°, SNB=83° and ANB=-5°(Fig.2b).

In our case, the treatment process consisted of three parts: preoperative orthodontic stage, orthognathic surgery stage and implant repair stage. Yantai Stomatological Hospital Review Board approved the clinical study and patient has been informed the surgical procedure and precaution, and signed the consent form. At the orthodontic treatment stage, we removed the tooth compensation, erected tooth 22, and moved tooth 25 to the tooth 24 position. Closed scattered spaces from tooth 13 to tooth 25 and concentrated missing spaces on tooth 15 and tooth 25. In the orthognathic operation stage, sagittal split osteotomy of bilateral mandibular ramus, anterior maxillary osteotomy and autogenous bone graft were performed under general anesthesia. The anterior maxillary incision was located in the tooth 15 and tooth 25 missing area. The anterior maxilla part moved forward about 2 mm and decreased about 2 mm and the distal bone mass of the mandible receded about 5 mm. In order to maintain the continuity, height and fullness of the bone, the removed mandibular bone was placed in the maxillary incision position(Fig.3). During the implant restoration phase, the postoperative orthodontics ended six months after orthognathic surgery. There was no obvious abnormality in the mucous membrane of the wound area, the bone tissue healed well, the alveolar ridge was edge-shaped in the bilateral edentulous region, and the mesiodistal width of the alveolar ridge was about 7 mm(Fig.4). Cone beam CT showed that the buccolingual bone width of tooth 15 was about 3 mm, the height of vertical bone was about 16 mm. The buccolingual bone width tooth 25 was about 3 mm, and the height of vertical bone was about 16mm(Fig. 5).

Bone augmentation operation was performed in the area of bone defect filled with Bio-oss bone powder, covered with Bio-gide membrane and fixed with titanium nail, the surface was covered with CGF and sutured tightly. One year after bone grafting alone, alveolar bone was found to be plump in the absence of teeth, occlusion space was obtainable, and mucous membrane was not abnormal. Cone beam CT showed that the buccolingual bone width of tooth 15 was about 7 mm, the height of vertical bone was about 14 mm. The buccolingual bone width tooth 25 was about 6 mm, and the height of vertical bone was about 16mm. Two straumann implants (4.1x10mm RN) were implanted in tooth 15 and tooth 25 and the postoperative x-ray showed the implant was in good position(Fig. 6). 7 months after implantation, Cobalt Chromium porcelain Crowns were used to repair tooth 15 and tooth 25(Fig. 7).

At revisit six months after completion of restoration, Bone tissue around implants healed well. variable values of cephalometric measurement before and after treatment were shown in the table 1.

Discussion

In 1967, subapical osteotomy was first used by Taylor et al.to treat anterior alveolar protrusion[1]. Anterior maxillary osteotomy (AMO) was performed through the anterior maxillary osteotomy to form tooth 13 to tooth 23 (or tooth 14 to tooth 24) segments of the tooth-bone, including anterior nasal spine and anterior osseous nasal floor. The tooth-bone segment was often retreated or moved upward to correct maxillary anterior teeth and alveolar bone deformities. However, the procedure adopted in our case was an unconventional anterior maxillary osteotomy. The tooth 14-24 tooth-bone segment was incised and moved forward and downward to improve the patient's Class III bone profile as well as to increase the mesiodistal space of missing tooth 15 and 25.

In this case, anterior maxillary osteotomy and anterior displacement can greatly simplify the surgical approach, increase the mesiodistal distance of the missing tooth area, provide enough space for implant restoration, and achieve good aesthetic and functional effects. In our case, the anterior maxillary osteotomy was performed with a labial vestibular incision. Therefore, The blood supply of free tooth-bone mass was mainly provided by the palatal periosteum, and the palatine periosteum was relatively compact, so the bone mass was moved forward in a limited range. After operation, the osteotomy block healed well and the corresponding teeth were free of pain and loosening. The bone and facial shape of the patient was improved effectively. The coordination degree of the upper and lower arches, the mismatch of the midline and the measurement parameters of the lateral position of the skull were obviously improved and reached the normal level basically(Fig.8). During 3 years of follow-up, the therapeutic effect was stable.

At present, autologous bone graft was a common method to solve serious bone defects and it was characterized by good bone guidance, no immune rejection, good induction of osteoblast differentiation and new bone formation[2]. However, its disadvantage lied in opening up a secondary operation area, which can easily lead to secondary injury and complications in the site of bone extraction, and bone resorption may sometimes occur after bone grafting[3]. In this case, the removed cortical bone fragments, which were obtained by sagittal split ramus osteotomy, were placed in tooth 15 and tooth 25 osteotomy area. After one year of follow-up, we observed the ideal vertical bone height of 16 mm and the mesiodistal distance of 7mm for both tooth 15 and 25 area. However, the absorption of the lip and tongue of bone tissue was more obvious (3mm for both tooth 15 and 25 area). It is attributed to the fact that only limited autogenous bone graft is used in the area of bone graft, no excessive bone graft is performed, and the barrier membrane is not covered by GBR at the same time, and the muscle tension of the buccal region in the region of bone graft is greater after operation[4].

This patient was a complex case with maxillofacial deformity with congenital missing teeth and insufficient implant space which affected the facial appearance and masticatory function. The combined application of orthodontic and orthognathic surgery can solve the Angle III bone facial shape of patients. Meanwhile, the modified orthognathic surgery method increased the mesiodistal space of the missing tooth area and reduced the difficulty of implant repair. In this case, multidisciplinary participation and cooperation resulted in a marked improvement in the patient's facial appearance and occlusion(Fig.9) Through the development of this case, we believe that for the complex skeletal malocclusion cases which needed implant repair, it was necessary to conduct multidisciplinary consultation before operation, and to establish individualized treatment for patients, in order to achieve the best repair effect.

Conclusion

The patients with skeletal malocclusion need to be treated with multidisciplinary cooperation in combination with the actual situation of the patients, so as to provide a comprehensive and reasonable individualized multidisciplinary treatment scheme for the patients, so as to ensure the feasibility of implant repair and improve the therapeutic effect.

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Table 1 variable values of cephalometric measurement before and after treatment

	Values before orthodontic stage	Values before orthognathic operation	Values after orthognathic operation
SNA	78°	79°	80°
SNB	83°	84°	78°
ANB	-5°	-5°	2°
SN/Gn	82.5°	83°	76.5°
SN/MP	36.5°	38°	39.5°
FMA	27°	28.5°	27°
FMIA	79°	70°	68.5°
IMPA	75°	82°	84°
1/NS	96°	103°	104°

Figure legends

Fig.1. Intraoral photographs obtained at the first visit.

Fig.2. Panoramic radiograph and lateral cephalometric radiograph obtained at the first visit.

Fig.3. The removed mandibular bone was placed in the maxillary incision position.

Fig.4. Intraoral photographs obtained after postoperative orthodontics.

Fig.5. A cone-beam computed tomography scan acquired prior to bone augmentation operation (a. sequential parasagittal views of tooth 25 ; b. Panoramic coronal view; c. sequential parasagittal views of tooth 15.

Fig.6. A Panoramic and periapical radiographs obtained after implants placement.

Fig.7. Intraoral photographs (a-e) and periapical radiographs (f-g) obtained after tooth 15 and tooth 25 repaired.

Fig.8.The cephalometric superimposition. Pretreatment (black line) and post-treatment (red line).

Fig.9.Facial photographs (frontal view and lateral view) obtained at different treatment stage (2013: the first visit; 2015: the preoperative orthodontic treatment stage completed; 2017: completion of restoration.).