

Case Report

Combined orthodontic and implant-supported prosthesis treatment in an adult patient with oral maxillofacial trauma: a case report

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Abstract: Dental injuries differ in classification and severity depending on the cause of the accident and the overall health of the patient. Car-related injuries, such as this case, are typically characterized by multi-dental, soft-tissue and supporting bone injuries. This report described a case of a 26-year-old male who suffered maxillofacial injury, fractures in mandible, and injuries to his permanent upper and lower incisors in a car accident. This patient received immediate treatment of fracture reduction and internal fixation at a local hospital. Six months after his initial treatment, the patient was referred to the Department of Stomatology of QiLu Hospital for orthodontic and implant-supported prosthesis treatment. His chief complaint was poor bite alignment and multiple missing teeth. For him, the treatment included orthodontic and implant-supported prosthesis to improve the occlusion relationship and esthetic at the anterior region. This case had been followed up by the Department of Stomatology. Clinical and radiographic examinations showed excellent esthetic results and the patient had been satisfied with the treatment. This case emphasizes the importance of a multidisciplinary approach to achieve an esthetic result.

Keywords: Oral maxillofacial trauma, orthodontic treatment, Implant-supported prosthesis treatment

Introduction

Despite the development of preventive measures such as the improvement of traffic laws and security device for all vehicles, physiological trauma remains a major health burden worldwide [1]. In a traumatic event, due to its exposure, the maxillofacial region has increased vulnerability to injury either in isolation or in combination with other systems [2]. The trauma group resulting from car-related injuries is usually dominated by multiple dental injuries, supporting bone injuries and soft-tissue injuries [4]. The number, type and severity of dental injuries vary according to the patient's age and the nature of the accident [3]. Recently published literatures show that road traffic crashes (RTCs), assault and inter-personal violence (IPV) are leading causes of maxillofacial injuries [5-7]. In trauma cases, multi-disciplinary cooperation is often required due to the complexity

of multi-factorial injuries. The present case report described the treatment procedure of a 26-year-old male suffering traumatic maxillary fracture and bimaxillary incisors injuries and received a combination of surgery, orthodontics and implant-supported prosthodontics therapy.

Case report

History

A 26-year-old male suffered car-accident-induced trauma to his mandibular bone and bimaxillary incisors. He received immediate reduction of fractured mandibular and internal fixation at a local hospital. Due to the complicated crown-root fracture, teeth 14, 15, 21, 26, and 27 were extracted during the surgery. Six months after his initial treatment, he was referred to the Department of Orthodontics and

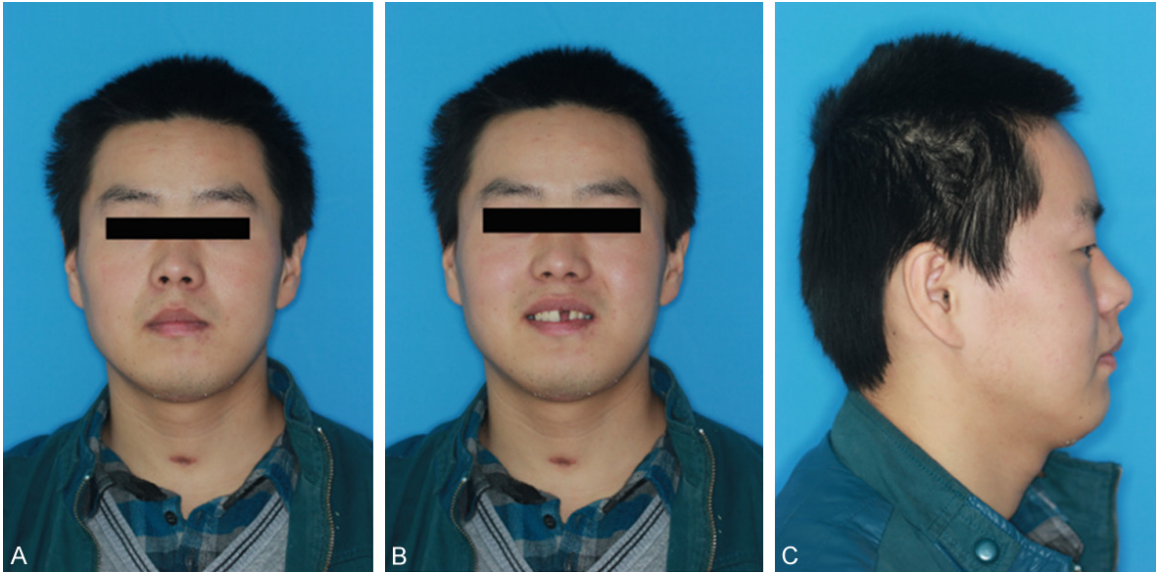


Figure 1. A-C: Pre-treatment extraoral photographs.

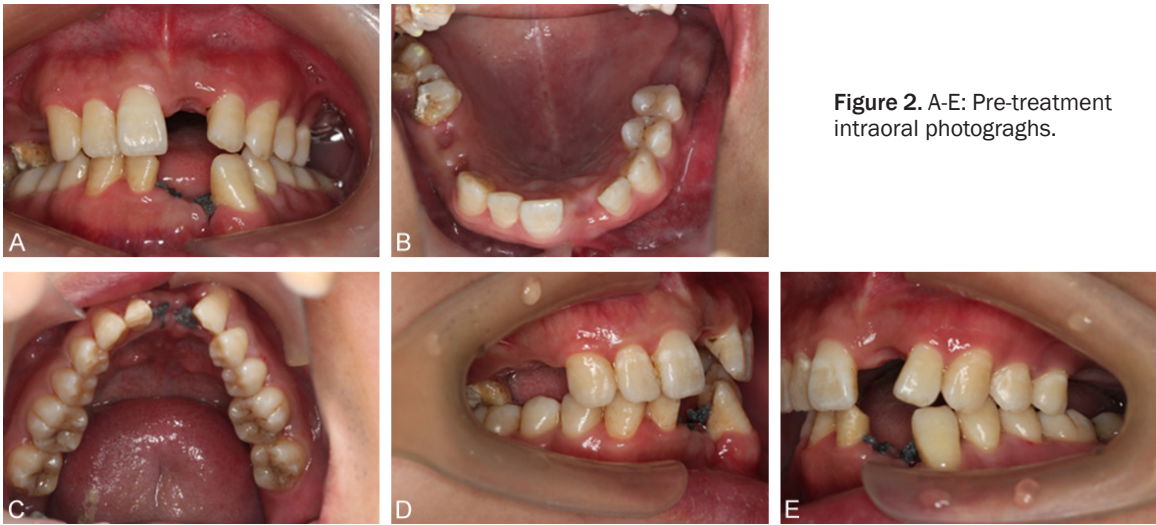


Figure 2. A-E: Pre-treatment intraoral photographs.

Prosthetics of QiLu Hospital of Shandong University. His chief complaint was poor bite alignment and missing teeth caused by the accident.

Clinical examination

Extra-oral examination revealed a normal profile without facial asymmetry (Figure 1) and TMJ examination revealed no pathological signs or symptoms. The intra-oral examination showed defects of dentition due to the missing teeth at 14, 15, 21, 26, 27, 31, 32, and 41. Tooth 42 presented with Grade III mobility;

tooth 16 was seriously decayed and had been briefly restored by glass ionomer; a shallow overbite was present in the anterior region, and tooth 22 had slightly shifted and rotated. There was malocclusion on the right posterior mandible, which included unilateral posterior lockbite. In addition, the anterior region showed shallow overbite and Grade I overjet (Figure 2).

Radiographic examination

Panoramic radiograph showed the catagmatic line was slight malposition and cephalometric radiographs revealed no obvious dysplasia in

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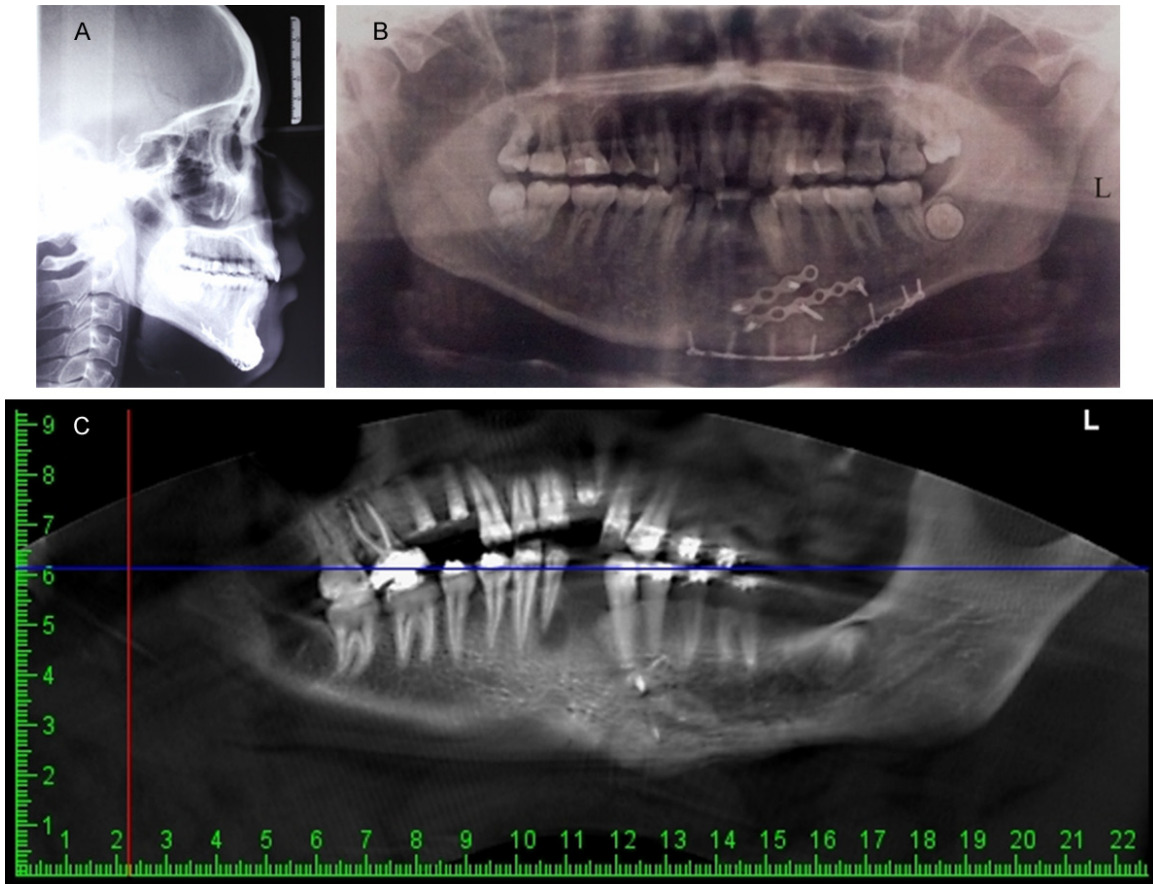


Figure 3. A, B. Preoperative X-rays: A. Cephalometric radiograph; B. Panoramic radiograph; C. Cone Beam CT shows the existing periapical periodontitis of 42.

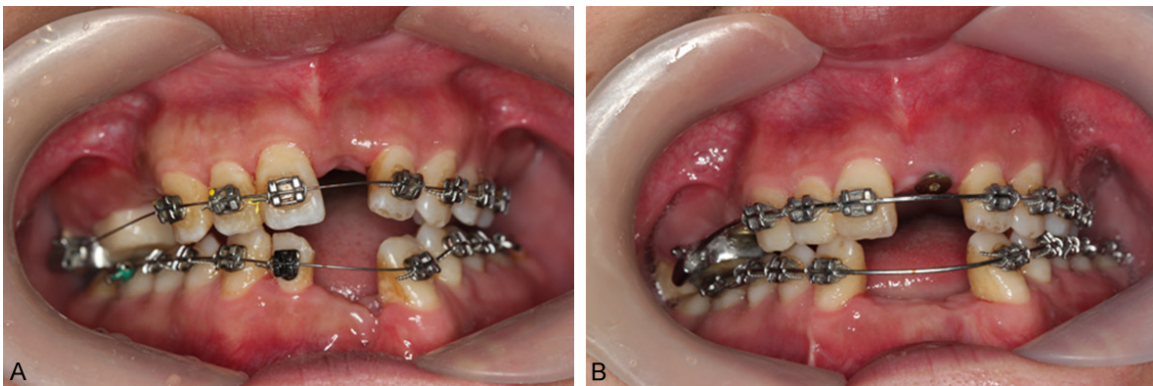


Figure 4. A, B: The initial stage and the final stage of the alignment with the 0.014 NITI round wire and the 0.019*0.025 Stainless Steel wire.

bone and jaw (**Figure 3**), periapical radiolucency at 42 was shown in the cone beam CT (**Figure 3C**).

Treatment progress

Before starting orthodontic treatment, the patient was referred for endodontic procedures

for tooth 16 and a temporary crown was fabricated to protect tooth 16 and facilitate the bonding of the bracket. Periodontal treatment included root planning, scaling and oral hygiene instructions (OHI).

Treatment was initiated using the straight wire appliance. A sequence of archwires was used

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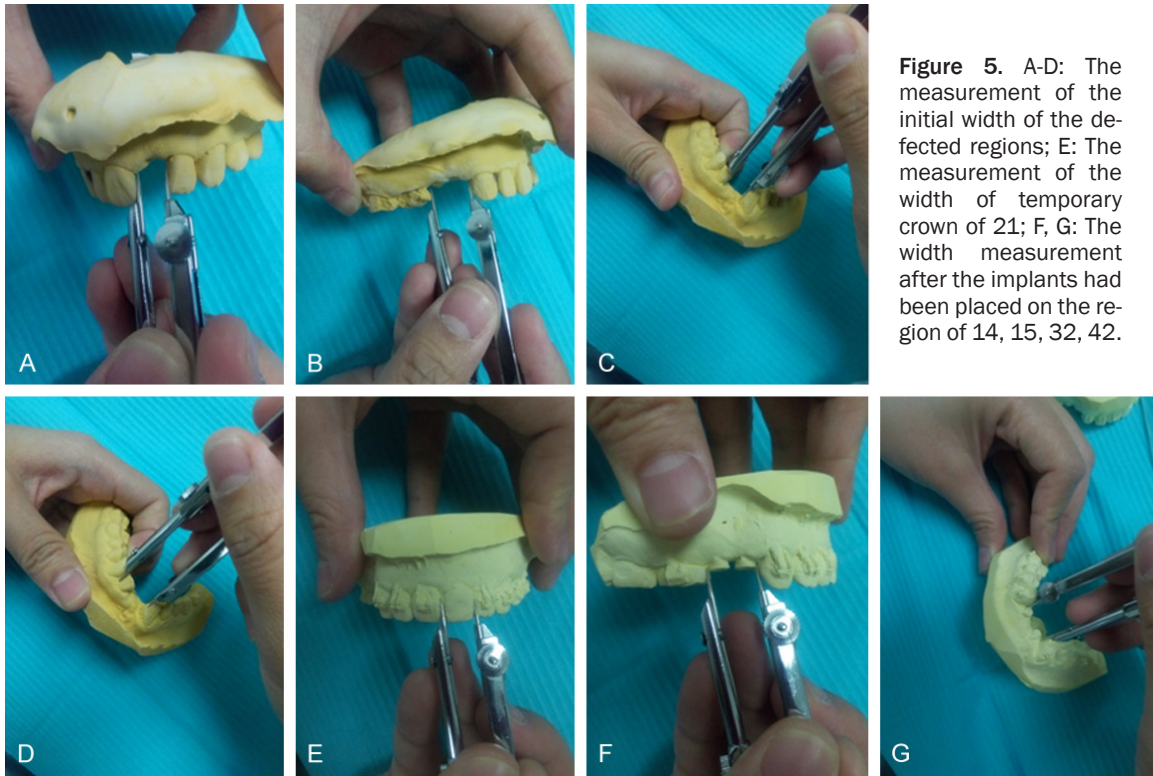


Figure 5. A-D: The measurement of the initial width of the defected regions; E: The measurement of the width of temporary crown of 21; F, G: The width measurement after the implants had been placed on the region of 14, 15, 32, 42.

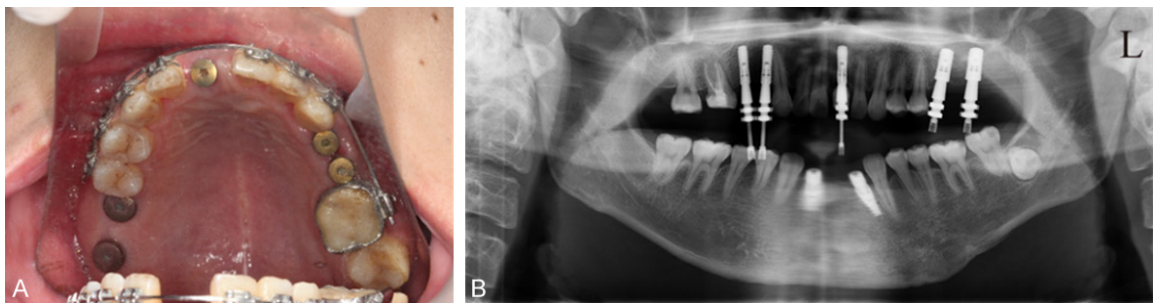


Figure 6. A, B: Intraoral image and panoramic radiograph showing the implants had been placed in maxillary.

to perform alignment and leveling. The utilization of archwire began with 0.012 in and 0.014 in NiTi, followed by 0.016 in, 0.018 in, 0.020 in, and 0.019 × 0.025 in brackets (**Figure 4**). Because the missing teeth should be replaced by the implant prostheses, the space between the nearest teeth should be calculated and designed to maintain proper width (**Figure 5**). About ten months later, the dentition was aligned appropriately and the spaces of 21, 14, 15, 26, and 27 were sufficient. The implants were placed in the maxillary alveolar bone in the first-stage of implant surgery (**Figure 6**). Before receiving the crown prosthesis, the gingival shape of tooth 21 was discovered to be

too flat in appearance, so a special method of gingival reconstruction was undertaken to achieve the esthetic result in the anterior region. The temporary crown (a resin crown combined with a temporary abutment) was applied to tooth 21 incrementally to extrude and mold the shape of the gingival and alveolar process (**Figure 7**). To achieve an esthetic and symmetrical result in the anterior region of the mandible, and taking into consideration the existing periapical periodontitis, tooth 42 was extracted and a plan was established to place four smaller incisors in the mandibular space. Expansion of the anterior mandibular space was performed with a 0.019 × 0.025 in stain-

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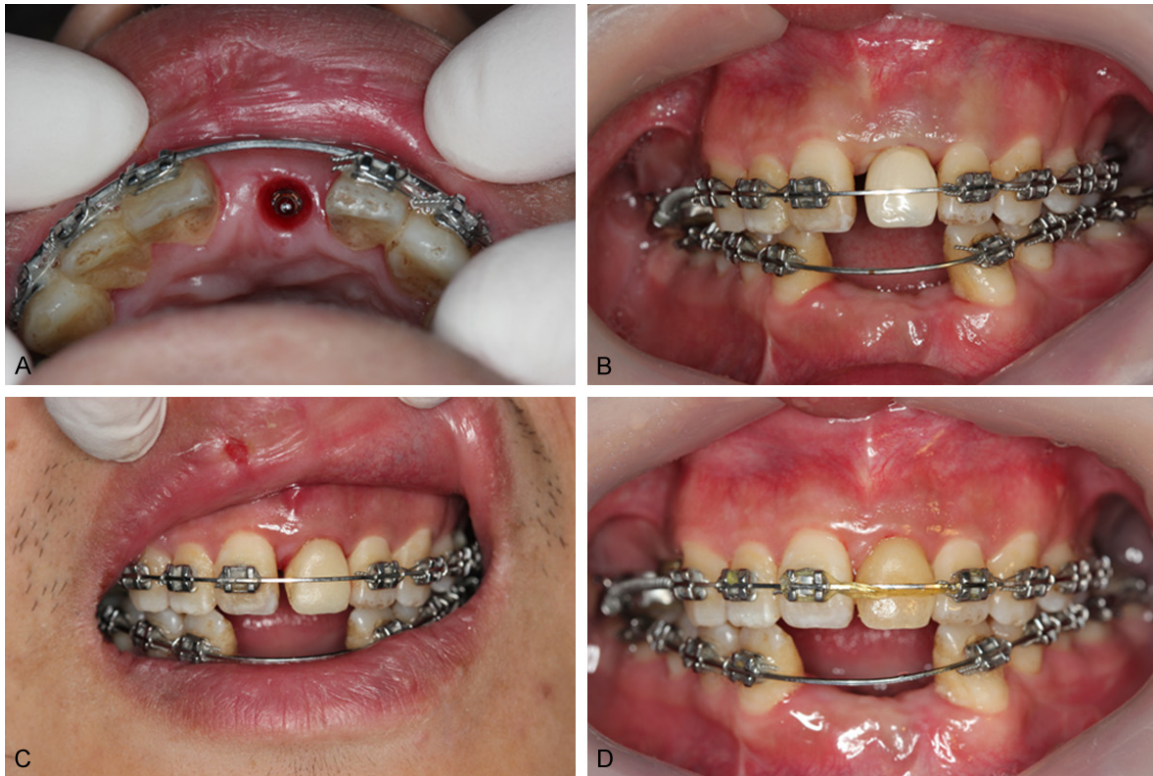


Figure 7. A-D: The provisional crown was changed monthly to reshape the gingival contour of 21.

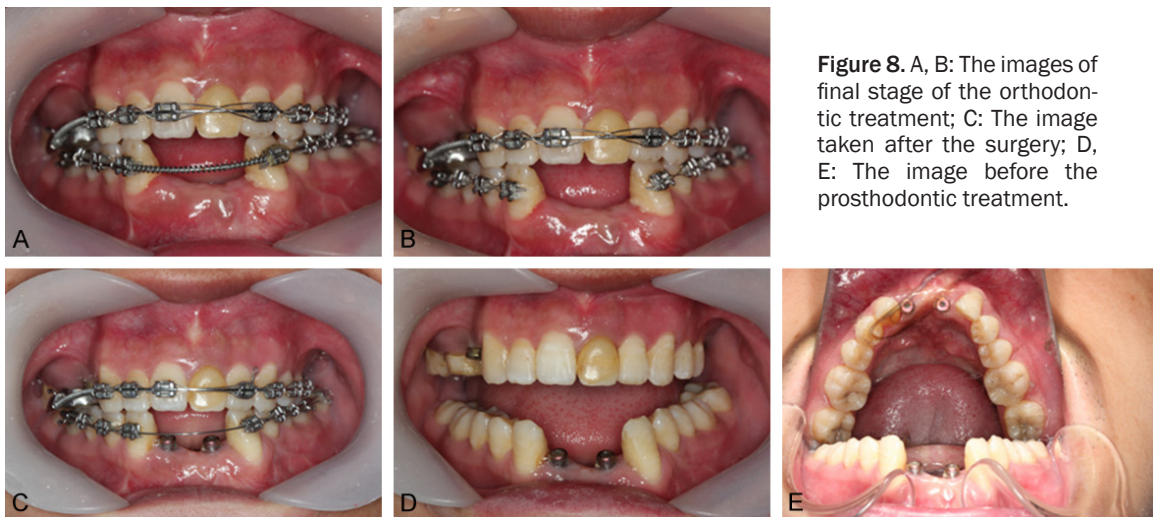


Figure 8. A, B: The images of final stage of the orthodontic treatment; C: The image taken after the surgery; D, E: The image before the prosthodontic treatment.

less steel archwire with NiTi coil-spring placed between 33 and 43. Adjustments of the archwire were performed monthly for eight months. When the space was sufficient, two implants were placed in the anterior mandible during the implant surgery (Figure 8). At the same time, the contour of gingival of 21 had returned to normal (Figure 9). Before taking an impression

for implant-supported prosthodontics, the cavity block of temporary crown 21 was created with silicone impression materials (Figure 10) and then molded with self-curing plastic and impression cap. This was done in order to obtain a precise impression of the gingival contour and to simulate the orientation of the final location of 21. Finally, the individual impression

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Figure 9. A, B: The gingival texture, color, and contour appeared similar to the adjacent soft tissues of the teeth.

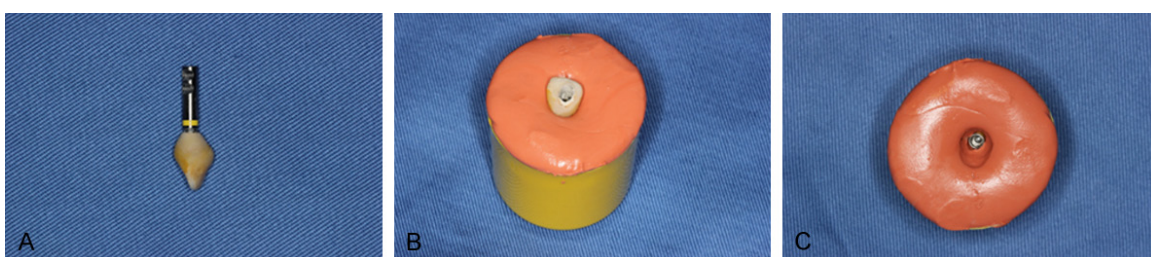


Figure 10. A-C: The cavity-block making process of the provisional crown of 21.

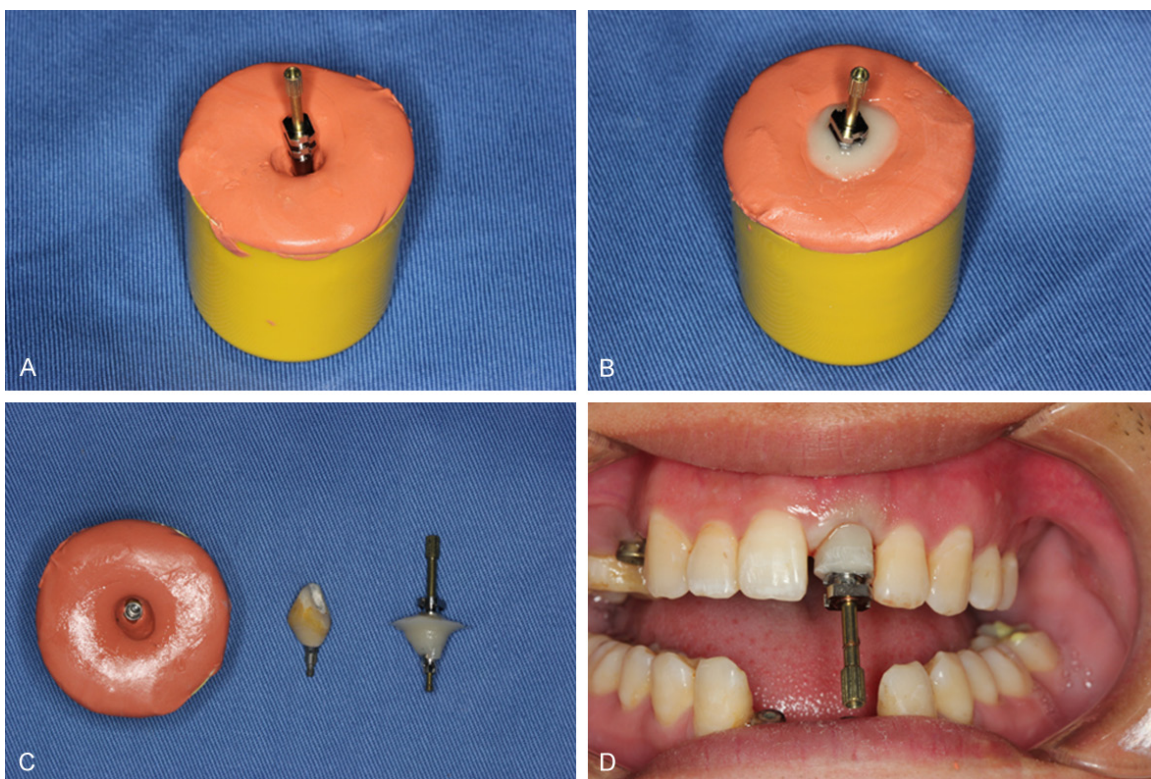


Figure 11. A-D: The processes of precise replication of margin shape of gingiva in aesthetic zone.

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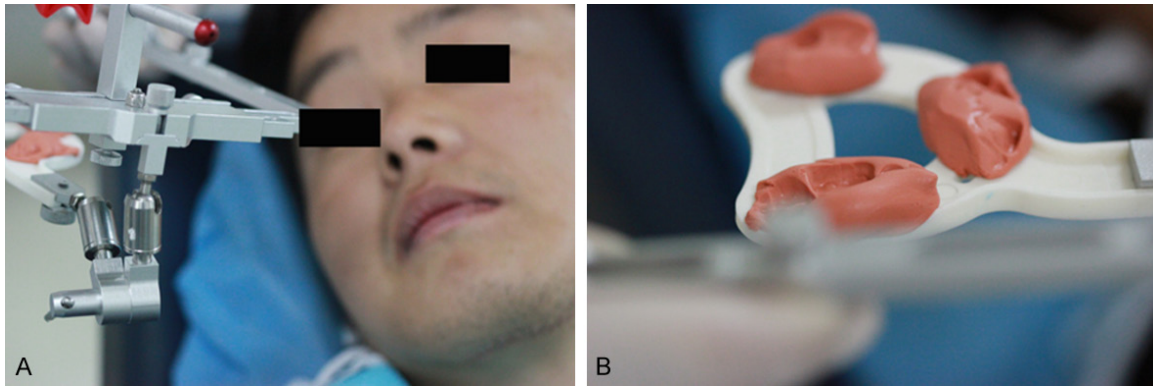


Figure 12. A, B: The utilization of multi-purpose face bow to confirm the occlusal relation.



Figure 13. A-C: The images before prosthodontic treatment; D: The intraoral image of orthodontic retainers; E-G: The final images after the prosthodontic treatment; H, I: The final CT after treatment.

cap was used for the final impression of implant 21 (Figure 11).

The orthodontic treatment duration was 22 months. After the appliance had been removed, a removable transparent retainer was placed in the dental arches. Before the prosthodontic treatment could continue, a face bow was used to establish the optimal placement of condyle and occlusion (Figure 12). After a fortnight, the

permanent porcelain prostheses were placed and bonded.

Treatment result

The active orthodontic treatment utilizing fixed appliances in both dental arches lasted for 22 months. Superimposition of the initial and final tracings of the lateral cephalometric X-rays indicated no significant anteroposterior change of

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incisors. The post treatment intra-oral photographs showed a normal overjet and overbite, the molars were corrected to a Class I relationship, and the Spee curve was aligned flat. The gingival shape of 21 was remodeled through gingivoplasty. Spaces where there was only one tooth missing were expanded by the appliance and acquired enough width for prosthesis. At the six-month follow-up, the results achieved by restorative and prosthodontic treatment were observed. There was great improvement in the esthetics of his smile. With the replacement of missing teeth, stable occlusion was achieved and function was restored (**Figure 13**).

Discussion

In the case of multiple dental injuries, treatment can be complex and may require a multidisciplinary team approach [8]. Dental trauma, especially to the permanent incisor, can cause aesthetic and functional problems, which in turn can result in social and emotional problems [9]. The present clinical report refers to the rehabilitation of a complex case of dentition defects and malocclusion caused by the trauma. Orthodontic treatment was used to obtain proper occlusion and to expand the spaces to provide enough room for the prosthesis, implant surgery, and esthetic restoration of anterior region.

In the case of aesthetic areas, the challenge of rehabilitation is great. Utilizing dental implants can significantly improve clinical results when the patient has lost teeth [10, 11]. To obtain an aesthetic result, it is necessary for the bone and gingiva in the labial region to maintain a proper shape. To this end, the temporary crown of 21 was changed monthly to reconstruct the hyperplastic gingiva (**Figure 7D**).

To expand and retain the spaces left by the missing teeth, the NiTi helical spring and temporary crown were utilized to maintain adequate width for implant-supported prosthodontics. During the expansion, the position of teeth and the relationship between the upper and lower jaw were adjusted to stabilize occlusion (**Figure 8B** and **8C**).

In the present case, it was essential to confirm the occlusion relationship between the upper and lower dental arch because of defects of posterior teeth. Malocclusion caused by tooth loss, bruxism, and nontreated dental caries are

sources of stress in temporomandibular joints. These conditions can activate a cascade of unfavorable events, including serious disorders [12]. The facebow was used to transfer the condyle position in centric relation occlusion to the articulator (**Figure 12**), which was essential for fabricating the final prostheses.

Permanent retention is possible, but relapse is difficult to predict due to numerous implant prostheses in the arches. After removing the appliance, the transparent retainer was also used to prevent relapse. According to Dr. Chen removable aligners are a good alternative for retention [13].

Orthodontic treatment of a patient with tooth migration is effective with multidisciplinary cooperation. The improvement of facial esthetics can contribute to the self-confidence of an adult patient with traumatic tooth migration and defects [14]. The patient should continue a program of regular follow-up visits to the orthodontist, and meticulous hygiene must be maintained. In general, with reasonable utilization of the prostheses and good oral hygiene the maintenance of good dental health and bone levels might remain consistent.

A patient diagnosed with defect dentition by trauma in the left mandibular region and anterior incisors was able to achieve satisfactory occlusion through a multidisciplinary approach. This approach included oral surgery, orthodontics, and implant-supported prosthodontics, the removal of adjacent teeth in the affected site by fixed appliance, and the placement of seven implants in the anterior and posterior region of the edentulous area. In this case, the patient was satisfied with both the aesthetic and occlusal outcomes of the multidisciplinary treatments provided.

Disclosure of conflict of interest

None.

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