

associated with facial fractures. The incidence of cervical spine injuries in the presence of facial fractures ranges from 1.3% to 4%.²¹ In our study, the incidence recorded was 1%. Our result was quite similar to that of Merritt and Williams in 1997 where the incidence was 1.8%,²² Beirne et al in 1995 having an incidence of 1.04%,²¹ Davidson and Birdsell in 1989 having an incidence of 1.3%.²³ The commonest injury seen in our study was fracture C6 and C7 vertebrae which was similar to the study by Davidson and Birdsell in 1989.²³

CONCLUSION

Periodical epidemiological reviews of facial trauma are important to confirm previously established patterns and to detect new characteristics that may help to develop preventive strategies and qualify therapeutic routines.⁵ Moreover, the evaluation of treatment effectiveness and the understanding of complications may provide a more realistic and consistent interpretation of how to manage these patients.⁵ Trauma should not only be seen exclusively as a medical condition, but also as a social and economic problem.⁵ Healthcare costs to treat victims, damage to property involved in traumatic event, losses in wages, and permanent or transient disability often lead to difficulties in the reintegration of victims into society and their return to work.⁵

This retrospective study analyzed a sample of 1146 maxillofacial trauma patients, there was a preponderance of males between ages 18 and 25 years, and main cause was road traffic accidents. Mandible was the most frequently fractured facial bone. Treatment consisted of open reduction and internal fixation or closed reduction depending on the site and type of fracture. Equal postsurgical complications were seen in both the techniques (11%). The few unusual highlighting points of our study were high rate of male predominance, maximum recorded patients were of mandibular fractures and unusual rates of plate infection which saw a drastic reduction after stainless steel plates were replaced by titanium. This shows that facial fracture statistics depends highly on demographics and may vary from area to area depending on the habits and customs of the people in that area.

This study is contributory to database which will help to manage pre-emptive situations leading to facial injuries which can affect physical wellbeing and psychologic aspects of patient as well as affect the economic status of society.

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Contour Restoration of Over-Resected Mandibular Angle and Lower Border by Reduction Mandibuloplasty Using Three-Dimensional Planning and Computer-Aided Design and Manufacturing Custom-Made Titanium Implants

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Objective: The purpose of this clinical report was to introduce a new methodology for contour restoration of the over-resected mandible by reduction mandibuloplasty using 3-dimensional (3D) planning and computer-assisted design and manufacturing (CAD-CAM) custom-made titanium implants.

Patient and method: A 20-year-old male patient had undergone reduction of the zygoma and mandibular angle and lower border for esthetic reason 1 year ago at a private clinic. However, he was not satisfied with surgical outcome and wanted to restore his original facial volume and contour. To assess the volume and dimension of resected bone, 3D-computed tomography (3D-CT) data at the original stage was superimposed with postsurgical CT. For restoration of the malar prominence, porous polyethylene malar implants with extensions into the lateral malar region (Medpor) were placed and fixed with microscrews. Custom-made titanium implants were fabricated for contour restoration of the mandibular angle and lower border using CAD-CAM technology (iDDA, Daegu, South Korea). Two-piece design per each titanium implant was adopted for easy placement and avoidance of tissue damage during placement. Thin buccal extension was incorporated for placement of screw holes. Location, direction, and length of bicortical screws were planned to avoid damage of the inferior alveolar nerve.

Result: With the help of 3D planning and CAD-CAM technology, rigid fixation of the custom-made titanium implants into the mandibular angle and lower border successfully restored the contour of over-resected mandible to the original state.

Conclusion: When over-resection by reduction mandibuloplasty becomes an issue, this method may be an effective treatment option for contour restoration of over-resected mandibular angle and lower border.

Key Words: CAD/CAM, mandible augmentation, over-resection, restoration of contour, titanium implant

The number of patients who undergo facial bone contouring surgery is increasing in Asian countries—especially South Korea.¹ Reduction mandibuloplasty in the mandibular angle and lower border has been usually performed in patients who have flat and square lower jaw line in order to create a slender face. As any other esthetic hard tissue surgeries, reduction mandibuloplasty also has inevitable complications and unsatisfactory results. One of the most common causes of patient dissatisfaction or complaint after reduction mandibuloplasty is over-resection of the mandibular angle and lower border, resulting in vertically long and excessively tapered lower jaw contour.²

Small defects from reduction mandibuloplasty can be treated with augmentation of the mandibular body and/or angle using alloplastic materials such as porous polyethylene (Medpor, Stryler, Kalamazoo, MI), polytetrafluoroethylene (ePTFE), silicone, or other particulate graft materials with or without barrier.^{3–5} There

are several disadvantages such as ill-fitting, palpability, migration, dead space, risk of infection, and poor physical properties compared with natural bone.^{6,7} To fill the large defects in the mandibular angle and body, custom-made Medpor or silicone implant can be fabricated using 3-dimensional (3D) planning, computer-assisted design and manufacturing (CAD-CAM), and 3D printing.^{3,6,8} However, customization of these materials does not resolve the issue of physical properties or long-term biocompatibility.

There are few clinical reports or studies, up to the authors' knowledge, about resolution of the complications after reduction mandibuloplasty and to overcome the limitation of physical properties of implants in facial bone contouring surgery. The purpose of this clinical report was to introduce a new methodology for contour restoration of the over-resected mandible using 3D planning, CAD-CAM custom-made titanium implants, and rigid fixation.

PATIENT AND METHOD

A 20-year-old male patient visited the Department of Oral and Maxillofacial Surgery, Seoul National University Dental Hospital (Seoul, Korea) with chief complaint of flat midface, long and tapered lower jaw, and excessive chin length (Fig. 1A). The patient had undergone malar reduction, mandibular angle reduction, and narrowing advancement genioplasty via T-osteotomy for esthetic reason 1 year ago at a private clinic. However, he was not satisfied with surgical outcome and wanted to restore his original facial volume and contour.

Surgical objectives included restoration of the malar prominence and the angle and lower border contour of the mandible to the original status. To assess the deficient volume and dimension of bone, 3D computed tomography (3D-CT) data at the original stage were superimposed with postsurgical CT as a reference for surgical planning and implant design (Fig. 1B).

For restoration of the malar width and volume, Medpor ready-made malar implants were fixed with 3 microscrews per each side. Fixation plates and screws from previous surgery were removed except for the right posterior zygomatic arch region.

According to difference in the volume and dimension of the mandible between original and postsurgical images, custom-made titanium implants were designed for restoration of the angle and lower border of the mandible using 3D data and CAD-CAM technology. Since the patient preferred the original shape of the left mandibular angle, the left side and its mirror image were used as references. The volume and dimension of titanium implant was designed to be slightly smaller than the resected bone, in consideration of thickened periosteal soft tissue due to fibrous scar formation. Since transoral approach was planned, 2-piece design per each titanium implant was adopted for easy placement and avoidance of tissue or nerve damage during placement. Thin buccal extension was incorporated for placement of screw holes. Locations, directions, and lengths of bicortical screws were planned to avoid damage of the inferior alveolar nerve during transbuccal approach. Finally, the design data were sent to titanium block milling facility for fabrication of the implants. Grade IV titanium block with dimensions of 20 mm × 20 mm × 40 mm was used for each piece of implant (Fig. 1C) (Arden 5X-WM, TPS Korea, Gwangju, Korea). Since the chin length was still excessive despite increase in the intergonial width with implant placement, 2 mm reduction of the lower border of symphysis was performed simultaneously (Fig. 1D).

RESULT

With the help of 3D planning and CAD-CAM technology, rigid fixation of the custom-made titanium implants into the mandibular angle and lower border successfully restored the contour of over-resected mandible to the original status (Fig. 1E).

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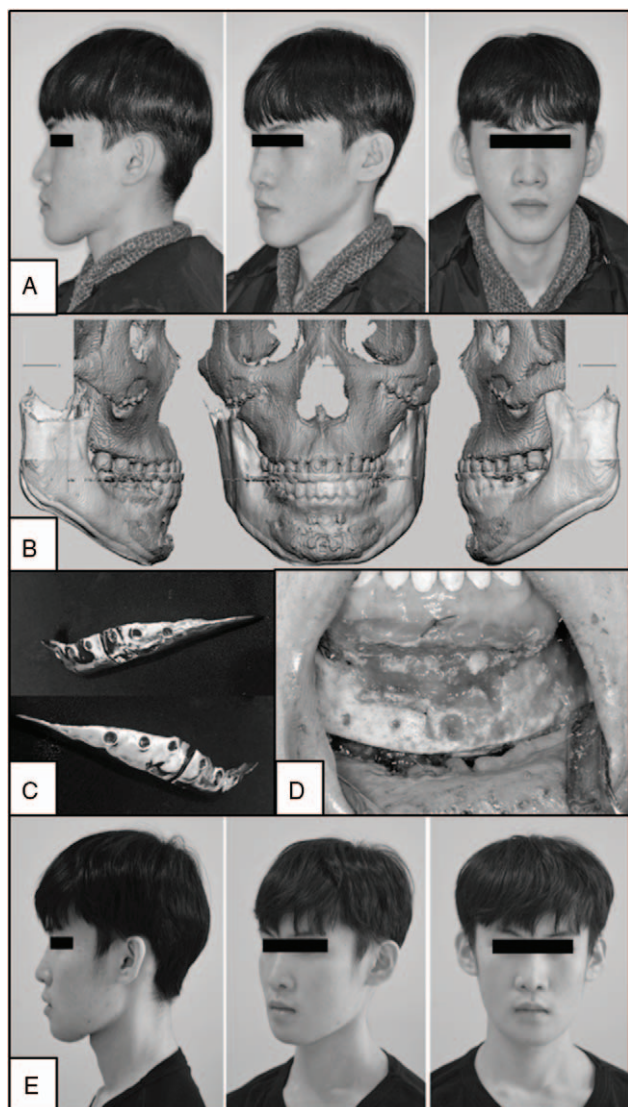


FIGURE 1. (A) Facial photographs of the patient who had undergone malar reduction, mandibular angle reduction, and narrowing advancement genioplasty for esthetic reason 1 year ago. (B) Superimposition of 3-dimensional computed tomography images between the original and postsurgical stages to assess the deficient volume and dimension of bone, as a reference for surgical planning and implant design. (C) Fabrication of the computer-assisted design and manufacturing custom-made titanium implants for contour restoration of the over-resected mandibular angle and lower border by reduction mandibuloplasty. Two-piece design per each implant was adopted for easy placement and avoidance of tissue and nerve damage during placement and thin buccal extension was incorporated for placement of screw holes. (D) Two millimeters reduction of the lower border of symphysis area to reduce the chin length. (e) Postoperative facial photographs.

DISCUSSION

Since the number of patients seeking surgical procedures for purely esthetic purposes is increasing, dissatisfaction patients are becoming an important issue. Over-resection by reduction mandibuloplasty may result from misplanning or inadequate surgical execution. Since full restoration of the over-resected mandible is difficult, the surgical outcome is often unsatisfactory. In patient with smaller gap or crater-like defects, it is possible to bridge or fill with alloplastic implants such as Medpor, ePTFE, silicone,

autogenous bone graft, or injectable hydroxyapatite graft. However, for large defects as seen in this report, use of alloplastic material might have several disadvantages such as time-consuming to carve alloplastic material into desired shape, difficulty in obtaining symmetry, poor physical properties compared with natural bone, questionable long-term biocompatibility, risk of migration, formation of dead space between bone and implant, and increase in risk of infection.^{4,5,7,9,10} Therefore, in this clinical report, custom-made titanium implants were used to restore mandible to the original state. The advantages of using custom-fabricated titanium implants are as follows: Titanium is one of the most biocompatible implant materials with a potential for osseointegration, and it can be relatively easily fabricated to conform to the contour of the resected mandible with the help of 3D planning and CAD/CAM technology.

There are 2 clinical reports of custom-made titanium onlay implants. Yates et al¹¹ reported that a unilateral titanium onlay implant designed by computer software and fabricated via milling technique was used for a patient with unilateral mandibular growth disturbance due to radiotherapy. Watson et al¹² reported a patient in which the mirror image of the normal side was used for fabrication of titanium alloy implant via direct metal laser sintering instead of milling technique. They used extraoral approach for placement of implant.¹² However, the present patient differs from these studies in terms of approach method, composition of implants, and number of side in the mandible: reference CT data, original CT data, intraoral approach, 2-piece design of implant, and bilateral restoration of the over-resected mandible.

To prevent slippage and increase the accuracy of positioning of titanium implants, it would be better to give geometric indentation at the margin of 2 pieces of implants and to use the surgical guide for locations of drill hole or implant.

CONCLUSION

When over-resection by reduction mandibuloplasty becomes an issue, this method may be an effective treatment option for contour restoration of over-resected mandibular angle and lower border.

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Nickel–Titanium Wire as Suture Material: A New Technique for the Fixation of Skin

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Purpose: To introduce nickel–titanium wire as suture material for closure of incisions in cleft lip procedures.

Method: Closure of skin incisions using nickel–titanium wire as suture material, with postoperative follow-up wound evaluation.

Results: There was excellent patient satisfaction and good cosmetic outcome.

Conclusion: Nickel–titanium wire is an excellent alternative for suture closure of cleft lip surgical incisions.

Key Words: Complication, Dermabond, nickel–titanium wire, suture

Cleft lip repair operation is one of the most commonly performed procedures in plastic surgery. The authors used nickel–titanium (NiTi) wire as suture material for cleft lip closure. The authors introduced this as a new technology.

In the past, the authors traditionally used synthetic sutures and staples. The basic principle of skin closure is to approximate the skin edges in an everted position.

Sewing of the wound using nonabsorbable sutures is often chosen in cleft lip operations with children. However, such an affixing procedure has disadvantages, primarily pain during suture removal. Another alternative is to use a tissue adhesive agent like Dermabond (Ethicon US, LLC, Somerville, NJ) for skin closure. It has been concluded that using a tissue glue results in an equal or a superior esthetic outcome. Cleft lip operation wound closures using octyl-2-cyanoacrylate (Dermabond; Ethicon) is indicated to accelerate the healing of wounds and enhance cosmetic outcome. Octyl-2-cyanoacrylate (Dermabond; Ethicon) is a common and expeditious method of closing skin wounds.¹ However, this affixing procedure has its disadvantages. One significant is that the surface

skin edge is not neat. Also, unless the surface layer of the skin has been sutured,² Dermabond (Ethicon) will inflow into the incision and may result in wound separation. Such gaping of wounds during the healing phase can lead to a wide scar.³

The purpose of our article is to describe a novel technique that is designed specifically to maximize esthetic outcomes.

Methods introduced the “NiTi wire suture line after adhesive skin closure” technique.⁴ The authors developed the “NiTi wire as suture material” described below. The technique combines the use of NiTi wire and nonabsorbable suture on the surface layer close of the skin.⁵

The NiTi wire is an alloy with shape memory, which has been introduced as a possible new suture material. The unique properties of NiTi wire make suturing easier, and it is not weakened by kinking. Its biocompatibility is similar to braided polyester, but it has superior mechanical properties.^{6,7}

The authors used interrupted sutures and nickel-titanium wire tissue intradermal suture closed incision, and compared the 2 methods of skin closure time, wound healing time, and the esthetic effect in cleft lip patients.

PATIENTS AND METHODS

Patients

A total of 20 patients, aged between 16 and 50 years, who had undergone standardized second deformity of cleft lip repair operations in our hospital between January 2015 and January 2017 were included in the study.

Methods

Cleft lip repairs are performed using a deep dermal closure, which maintains the skin to permit a tension-free closure. After obtaining a satisfactory deep dermal closure of the lip with NiTi memory stapling intradermal sutures (Shaanxi Futai Medical Technology Co Ltd., Xi'an, China), several interrupted, 6-0 Prolene (Ethicon) horizontal sutures are placed along the incision line where skin involution was not neat. The nickel-titanium wire tissue in skin surface under 1 mm parallel needle, the memory alloy wire to streamline the state with S shape buried in the incision on both sides of the tissue after intradermal suture, the needle cut. After 8 days of wound healing, the suture was cut with tight end clip, and pulled out from the other end of the wire. After intradermal extraction, the memory alloy suture left a natural appearing skin incision and natural everting.

Six months after the operation, the incision scar was observed, and the subjective evaluation according to the esthetic degree was good.

RESULTS

At a 6-month term follow-up using the “NiTi memory stapling intradermal suture,” the authors did not encounter wound infection, wound dehiscence, and pain at the wound sites—complications that sometimes are noted with earlier procedures. The cosmetic outcomes as assessed by the surgeons are good. Patients were also satisfied with the cosmetic results.

Representative Patient 1

A 40-year-old female patient presented suffering second deformity of cleft lip. A 6-month postsurgery follow-up showed a well-healed repair (Fig. 1A-D).

DISCUSSION

The white skin on the upper lip has traditionally been closed with nonabsorbable Prolene (Ethicon) sutures. These required removal

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