ARCHIVES OF CRANIOFACIAL SURGERY
Arch Craniofac Surg Vol.26 No.1, 1-4
https://doi.org/10.7181/acfs.2024.00563

Review Article

Current concepts in genioplasty: surgical techniques, indications, and future perspectives

Seungjun Lee, Baek-kyu Kim

Department of Plastic and Reconstructive Surgery, Seoul National University Bundang Hospital, Seoul National University College of Medicine, Sungnam, Korea

Genioplasty is a crucial procedure in maxillofacial and craniofacial surgery for both aesthetic and functional chin correction. The procedure is performed using various techniques—including sliding genioplasty, advancement, setback, vertical augmentation, and narrowing genioplasty—with each approach offering specific benefits tailored to patient needs. Advances in virtual surgical planning, pre-bent absorbable plates, and three-dimensional printing technology have enhanced the precision of genioplasty, leading to improved functional and aesthetic outcomes. This review examines the historical evolution, contemporary techniques, clinical outcomes, and future directions of genioplasty, with a focus on technological advancements that increase procedural accuracy and patient satisfaction.

Abbreviations: 3D, three dimensional; AI, artificial intelligence; CT, computed tomography

Keywords: Chin / Facial bones / Genioplasty / Mandibular osteotomy

INTRODUCTION

Genioplasty, the surgical modification of the chin, is a fundamental procedure in craniofacial and maxillofacial surgery that addresses both aesthetic and functional deformities. Initially used to correct microgenia and mandibular asymmetry, genioplasty is now frequently integrated with orthognathic surgery to achieve comprehensive facial profile improvement. Advances in digital imaging have revolutionized these techniques through innovations such as computer-assisted planning, virtual surgical simulations, and pre-bent fixation plates, all of which enhance precision and predictability. With the increasing incorporation of three-dimensional (3D) printing technology and artificial intelligence (AI)-assisted planning, genioplasty is evolving into a more refined and personalized approach. This article reviews genioplasty techniques, indications, advancements, and emerging trends [1,2].

Correspondence: Baek-kyu Kim
Department of Plastic and Reconstructive Surgery, Seoul National University Bundang Hospital, Seoul National University College of Medicine, 82 Gumi-ro 173beon-gil, Bundang-gu, Seongnam 13620, Korea
E-mail: plasrecon@gmail.com

How to cite this article:
Lee S, Kim BK. Current concepts in genioplasty: surgical techniques, indications, and future perspectives. Arch Craniofac Surg 2025;26(1):1-4. https://doi.org/10.7181/acfs.2024.00563

Received December 2, 2024 / Revised December 2, 2024 / Accepted February 19, 2025

HISTORICAL BACKGROUND

Genioplasty has a long history dating back to the 19th century when Hullihen [3] first performed mandibular osteotomy for skeletal prognathism. Hofer [4] later introduced extraoral approaches for genioplasty. In the 1950s, Trauner and Obwegeser [5] refined these methods by developing intraoral techniques, which significantly reduced invasiveness and improved postoperative outcomes. Over the decades, improvements in osteotomy design, fixation methods, and 3D imaging have led to greater predictability and enhanced aesthetic and functional results.

SURGICAL TECHNIQUES OF GENIOPLASTY

Genioplasty procedures are categorized based on the specific

www.e-acfs.org
pISSN 2287-1152
eISSN 2287-5603

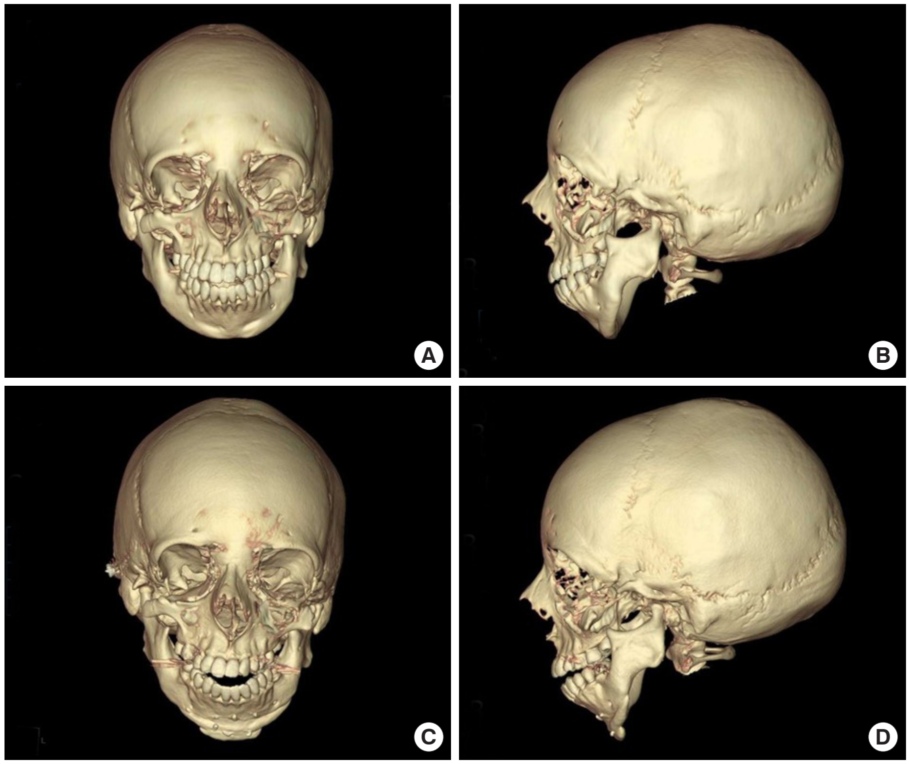

Fig. 1. A 24-year-old woman who underwent advancement genioplasty with two tier osteotomy. Preoperative anteroposterior/lateral (A, B) and 4-year postoperative anteroposterior/lateral (C, D) three-dimensional computed tomography.

skeletal modifications performed. In sliding genioplasty, a horizontal osteotomy is used to reposition the chin anteriorly or posteriorly, thereby improving projection and contour [6]. Advancement genioplasty, employed for microgenia, moves the chin forward to enhance prominence (Fig. 1) [7]. Setback genioplasty decreases chin projection and is effective for patients with mandibular prognathism [8]. Vertical augmentation genioplasty utilizes bone grafting or distraction osteogenesis to lengthen the chin and improve lower facial balance [9]. Conversely, vertical reduction genioplasty addresses excessive chin height by removing surplus bone [10]. Narrowing genioplasty, which is common in Asian aesthetic surgery, contours the chin to produce a more tapered appearance (Fig. 2) [9]. Recent studies have described a technique that combines narrowing genioplasty with a pedicled interpositional bone graft; this method repurposes the discarded central segment to elongate the chin and enhance facial harmony [11]. Surgical precision is critical in genioplasty. Preserving the mental nerve is essential to avoid neuropraxia and sensory deficits [6]. Rigid fixation using pre-bent absorbable plates or titanium screws enhances stability and minimizes the risk of relapse [10]. Moreover, proper soft tissue management—particularly adequate tensioning of the mentalis muscle—is crucial in preventing chin ptosis and lower lip incompetence [7].

INDICATIONS AND PATIENT SELECTION

A recent study by Hwang et al. [2] proposed a strategic categorization of genioplasty procedures based on the complexity of skeletal movements. The study divided 208 patients into three groups: those requiring horizontal segment osteotomy without significant vertical alterations; those undergoing both vertical and horizontal segment osteotomy for chin narrowing and reshaping; and those needing additional bone grafting for structural augmentation and stability. This classification provides a framework for customizing surgical approaches to meet individual patient needs, thereby enhancing predictability and optimizing outcomes. The study reported a 92.8% patient satisfaction rate, with a minimal complication rate of 5.8% attributable to temporary sensory loss [2]. Another study investigating soft-tissue responses following genioplasty with anterior segmental osteotomy analyzed 62 patients, categorizing them into advancement, setback, and no sagittal change groups. The results demonstrated stable outcomes with no significant relapse and a strong correlation between soft- and hard-tissue movements, particularly in setback genioplasty, supporting its use as an alternative to two-jaw surgery for bimaxillary prognathism with

Fig. 2. A 27-year-old woman who underwent bilateral zygoma reduction, mandible angle corticectomy and narrowing genioplasty. Preoperative anteroposterior photograph/3D-CT (A, B) and overlapped lateral photograph (C). Postoperative anteroposterior photograph/3D-CT (D, E) and overlapped lateral photograph (F). 3D-CT, three-dimensional computer tomography.

macrogenia [12]. Furthermore, research on narrowing and lengthening genioplasty has introduced a technique using a pedicled interpositional bone graft derived from discarded bone during narrowing genioplasty to elongate the chin in patients with a short and wide lower face. This method minimizes complications typically associated with free bone grafts, such as infection and resorption, while providing satisfactory aesthetic outcomes [11]. Beyond this categorization, genioplasty is indicated for various clinical conditions, including microgenia, macrogenia, facial asymmetry, and obstructive sleep apnea [8]. When combined with mandibular advancement, genioplasty has been shown to improve airway patency in obstructive sleep apnea patients. A comprehensive preoperative evaluation—including cephalometric analysis, 3D imaging, and virtual surgical planning—is essential for ensuring optimal patient selection and surgical accuracy.

RECENT ADVANCEMENTS IN GENIOPLASTY

Technological advancements have greatly enhanced genioplasty procedures. Virtual surgical planning facilitates precise 3D modeling and improves the accuracy of osteotomy execution [8]. The advent of 3D-printed cutting guides enables customized bone resection and fixation, thereby reducing intraoperative errors. Additionally, pre-bent absorbable plates promote bone healing, provide stability, and minimize implant-related complications [7]. AI has further advanced orthognathic surgery by improving preoperative planning, surgical precision, and postoperative outcome predictions. Through AI-assisted radiographic tracing, 3D modeling, and intraoral scanning, clinicians can accurately identify clinical landmarks, optimize implant design, and predict surgical outcomes [13].

CLINICAL OUTCOMES AND PATIENT SATISFACTION

Genioplasty has consistently demonstrated high success rates in terms of both aesthetic enhancement and functional improvement. Studies report that over 90% of patients are satisfied with their outcomes, particularly when genioplasty is performed in conjunction with orthognathic surgery or complementary procedures such as fat grafting. Long-term results remain stable with minimal relapse when appropriate fixation techniques are utilized. The integration of virtual surgical planning and advanced fixation methods has further enhanced postoperative predictability [7].

FUTURE DIRECTIONS

Continued technological advancements are shaping the future of genioplasty. AI-driven customization is poised to offer predictive analytics for personalized surgical outcomes and simulation [13]. Robotic-assisted surgery is expected to further enhance the precision of osteotomy execution and fixation placement [10]. Bioprinting of bone grafts has the potential to revolutionize chin augmentation by providing patient-specific biomaterial implants with improved integration properties. Additionally, the development of minimally invasive techniques—including endoscopic and robotic-assisted genioplasty—is under exploration with the aim of reducing surgical morbidity and shortening recovery time [8].

CONCLUSION

Genioplasty remains a fundamental procedure for modifying chin morphology in maxillofacial surgery. Ongoing advancements in surgical techniques, digital planning, and biomaterials have improved accuracy, safety, and patient satisfaction. The incorporation of AI, robotics, and bioprinting is expected to further refine genioplasty, making the procedure more precise and less invasive. As technology continues to progress, genioplasty will evolve to offer patients increasingly safe and effective treatment options.

NOTES

Conflict of interest

No potential conflict of interest relevant to this article was reported.

Funding

None.

Patient consent

The photographs in Figs. 1 and 2 were provided by the author, Baek-kyu Kim, after obtaining informed consent from patients.

ORCID

Seungjun Lee https://orcid.org/0000-0003-4992-0636
Baek-kyu Kim https://orcid.org/0000-0001-9974-5165

Author contributions

Conceptualization: Baek-kyu Kim. Data curation: Seungjun Lee, Baek-kyu Kim. Formal analysis: Seungjun Lee, Baek-kyu Kim. Methodology: Seungjun Lee, Baek-kyu Kim. Writing - original draft: Seungjun Lee, Baek-kyu Kim. Writing - review & editing: Baek-kyu Kim.

REFERENCES

1. Shokri T, Rosi-Schumacher M, Petrauskas L, Chan D, Ducic Y. Genioplasty and mandibular implants. Facial Plast Surg 2021;37:709-15.
2. Hwang CH, Na YS, Lee MC. Aesthetic genioplasty based on strategic categorization. Plast Reconstr Surg 2023;152:737-45.
3. Hullihen SP. Case of elongation of the under jaw and distortion of the face and neck, caused by a burn, successfully treated. Am J Dent Sci 1849;9:157-65.
4. Hofer O. Operation der prognathie und mikrogenie. Deutsche Zahn-, Mund-, und Kieferheilkunde 1942;9:121-32.
5. Trauner R, Obwegeser HL. The surgical correction of mandibular prognathism and retrognathia with consideration of genioplasty: Part II. Operating methods for microgenia and distoclusion (Cont'd). Oral Surg Oral Med Oral Pathol 1957;10:899-909.
6. Bell WH. Correction of mandibular prognathism by mandibular setback and advancement genioplasty. Int J Oral Surg 1981;10:221-9.
7. Degala S, Choudhary A. Genioplasty: a review. Niger J Clin Pract 2024;27:683-95.
8. Gursky AK, Chinta SR, Wyatt HP, Belisario MN, Shah AR, Kantar RS, et al. A comprehensive analysis of genioplasty in facial feminization surgery: a systematic review and institutional cohort study. J Clin Med 2024;14:182.
9. Lee EI. Aesthetic alteration of the chin. Semin Plast Surg 2013;27:155-60.
10. Ferretti C, Reyneke JP. Genioplasty. Atlas Oral Maxillofac Surg Clin North Am 2016;24:79-85.
11. Lee S, Kim BK, Baek RM, Han J. Narrowing and lengthening genioplasty with pedicled bone graft in contouring of the short and wide lower face. Aesthetic Plast Surg 2013;37:139-43.
12. Kim HY, Han SB. Soft-tissue response following genioplasty combined with anterior segmental osteotomy. Plast Reconstr Surg 2024;153:54e-63e.
13. Yeganeh A. Application of artificial intelligence in different fields of oromaxillofacial surgery. Digit Med Health Technol 2023;2:1-13.