

# A Study on Semi-automatic Fibular Transfer Planning in Mandibular Reconstruction

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## Abstract

In preoperative planning of mandibular reconstruction with fibular segments, it is necessary to determine the osteotomy lines and the proper placement of the segments. Interactive planning software [1, 2] is recently utilized in preoperative decision making, and surgeons are able to objectively analyze the surgical plan based on quantitative indicators. However, a time-consuming trial-and-error process is needed to obtain a better reconstruction pattern because manual 3D operation is required for adjustment of the fibular segments.

This study aims to develop a semi-automatic fibular transfer planning system based on both interactive operation and automatic placement of fibular segments. We formulate the placement process as an optimization problem that minimizes the shape error [2] between the surfaces of the patient's original mandible and of the fibular segments. The position of the connecting points of each segment is explored under the local shape constraint using a gradient-based search algorithm (Figure 1). In this presentation, we report some automatic placement results in 2-segment and 3-segment case and discuss applicability to practical preoperative planning.

**Keywords:** Surgical process modeling, automated planning, mandibular reconstruction

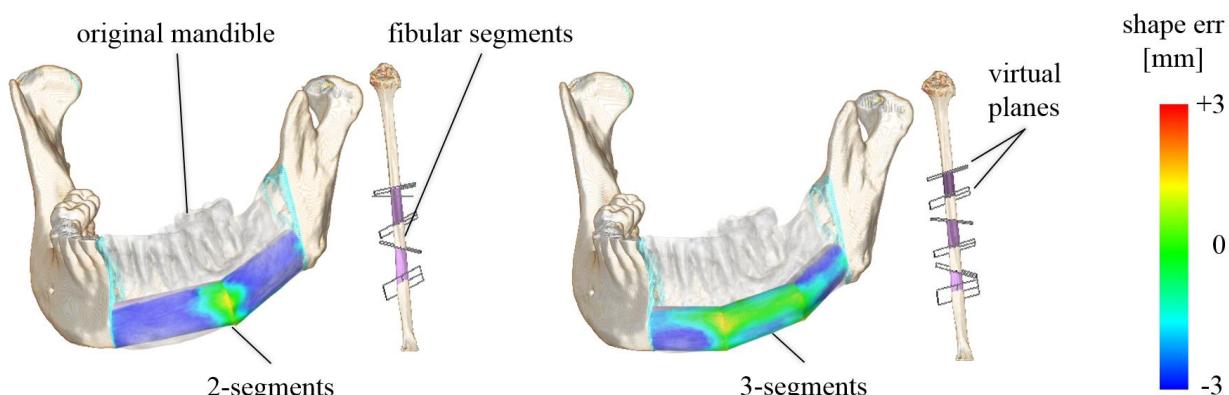


Figure 1. Automatic placement results with a gradient-based search algorithm

## References

- [1] A. K. Antony, W. F. Chen, A. Kolokythas, K. A. Weimer, M. N. Cohen, "Use of Virtual Surgery and Stereolithography-Guided Osteotomy for Mandibular Reconstruction with the Free Fibula", *Plast. Reconstr. Surg.*, Vol. 128, No. 5, pp. 1080-1084, 2011.
- [2] M. Nakao, M. Hosokawa, Y. Imai, N. Ueda, T. Hatanaka, T. Kirita and T. Matsuda, "Volumetric Fibular Transfer Planning with Shape-Based Indicators in Mandibular Reconstruction", *IEEE Journal of Biomedical and Health Informatics*, Vol. 19, No. 2, 2015. DOI: 10.1109/JBHI.2014.2320720