A Study on Sparse Shape Modeling for Fibular Transfer Planning in Mandibular Reconstruction

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Abstract

Preoperative planning using computer-aided design with 3D CT data is an active area of research. For mandibular reconstruction with fibular segments, it is necessary to determine osteotomy lines for fibular shapes and the precise placement of fibular segments in the mandible, but recent interactive planning software [1] cannot secure objectivity of the planning and time-consuming trial-and-error processes are required.

In this study, we propose an automated preoperative planning method that estimates a plan fitted to the data of a new patient using a planned dataset of previous patients. The proposed method introduces sparse shape modeling using sparse shape composition [2]. In this modeling, we select a subset of the data from a prepared preoperative planning dataset to make an example or instance of reconstruction via a linear combination of the data. We conduct experiments using the dataset planned by medical doctors and compare the instance estimated by the proposed method to the manual placement by these doctors.

Keywords: machine learning, mandibular reconstruction, computer assisted surgery.

Figure 1. Comparison of fibular transfer planning results for (a) the manual placement given by surgeons, (b) the proposed sparse modeling, (c) the non-sparse modeling, and (d) the best-fit training data.

References