PERSPECTIVE

J Oral Maxillofac Surg
■:■-■, 2020

Preservation of Inferior Alveolar Nerve Using the Dynamic Dental Implant Navigation System

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Alveolar bone resection or debridement is a common surgical technique performed in the oral and maxillofacial surgery department for the treatment of chronic osteomyelitis and benign lesions of the bone. The most common complications include incomplete resection of the lesion resulting from of variations that make it difficult to identify the margin, and injury to the inferior alveolar nerve. However, complete removal of the necrotic bone is important because of the risk of disease recurrence.[1]

Interactive image-guided surgery systems were initially developed for use in neurosurgery but are also used in craniomaxillofacial surgery.[2] However, interactive image-guided surgery systems have some disadvantages. The general medical navigation system is straightforward for surgeons to use in the midfacial area owing to the presence of immovable parts. However, the mobility of the mandible makes it difficult to synchronize the positions using preacquired images.[3]

The accuracy and precision for implant placement were achieved using dental navigation between the upper and lower jaws. In the dynamic approach, the computer registers the jaw and its appearance in the preoperative computed tomography (CT) image and provides on-screen real-time guidance to the surgeon.[4]

An 86-year-old woman came to our clinic with an unhealed extraction wound and pus discharge in the anterior part of the mandible. She complained of numbness in the left lower lip of 4 months' duration. The patient had taken oral aledronic acid (Fosamax; Merck, Kenilworth, NJ) for 5 years and had then taken denosumab (Prolia; Amgen, Thousand Oaks, CA) once 3 months before her presentation. She had no history of radiation therapy. The necrotic bone was exposed $\sim 2 \times 1.5$ cm, the gingiva was inflamed, and purulent discharge was observed. Only the right mandibular canine and a residual root of the right first premolar were retained. Panoramic radiography revealed an osteolytic area between the right mandibular canine and left mental foramen with an intact inferior border of the mandible. From these findings, the stage 2 medication-related osteonecrosis of the jaw was diagnosed.

An intermaxillary fixation *screw* was inserted into the exposed necrotic bone. CT revealed an ill-defined osteolytic and sclerotic lesion over the symphysis close to the left mental foramen with an intact lingual cortex and a residual inferior border of the mandible ~7 mm in height. A reconstruction plate was adapted to a 3-dimensional printed model of the mandible before the surgical procedure. The DICOM (digital imaging and communications in medicine) data set of the CT scan was imported into the Navident software to analyze the case and trace the left mental nerve (Navident, version R2.1.1; ClaroNav Inc, Toronto, ON, Canada). The right mandibular canine, bilateral mental nerve, and a temporary screw were set as landmarks for registration during surgery.

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Conflict of Interest Disclosures: None of the authors have any relevant financial relationship(s) with a commercial interest.

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Received December 6 2019
Accepted January 8 2020

0278-2391/20/30022-7
https://doi.org/10.1016/j.joms.2020.01.007

FIGURE 1. Surgical procedure using the navigation system to aid in determining the definite necrotic bony margin.

Chen, Chiu, and Peng. Dynamic Dental Implant Navigation System. J Oral Maxillofac Surg 2020.

The patient underwent surgery under general anesthesia using the dynamic navigation system with preservation of the left mental nerve. A mandibular tracker was attached to the inferior and posterior part of the ridge on the right side with circummandibular wiring after setting the reconstruction plate temporarily. Sequestrectomy and saucerization were performed using a Stryker handpiece (Stryker Corp, Kalamazoo, MI) attached to the tracer tag (Navident, ClaroNav Inc., Toronto, Canada) after the trace registration procedure to locate the clear infected bony margin, mental nerve, and incisive branch anatomy (Fig 1). Tension-free closure was achieved after placing a platelet-rich fibrin membrane dressing over the bony surface. Wound healing was uneventful, and the patient achieved full recovery of lip sensation at the 1-month follow-up appointment (Supplemental Video 1).

A dynamic navigation system such as Navident (ClaroNav Inc) offers better accuracy during implant surgery for the surgeon. Hasan et al[5] reported a noninvasive medical-grade titanium bone clamp to fix the mandible securely, with tracking instruments registered on the cone beam CT-obtained images. It is suitable for oncologic surgeries and large reconstructions around the mandible. In our application, it was useful for real-time visualization of the anatomic structures during dentoalveolar surgery and overcame the issue of the mobility of the mandible, which is difficult to register and navigate.

Acknowledgments

Thanks to Renee (www.enago.com) for English editing of our report.

Supplementary Data

Supplementary Video associated with this article can be found in the online version, at https://doi.org/10.1016/j.joms.2020.01.007.

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