



Case Report

Intraoperative navigation-assisted accurate bone lid surgery to remove a mandibular lesion: A case report



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ABSTRACT

Bone lid surgery is a valid method for maxillofacial surgery as it can avoid the large bone defects secondary to access osteotomies. A precise and careful osteotomy together with firm placement of the bone lid in its original position enables better bone healing. Computer-assisted intraoperative navigation has recently evolved to improve the precision and simplify this surgical procedure. However, the application of computerized navigation-assisted surgery to the mandible is complicated because of its mobility. Here we present the feasible modified application of bone lid surgery to mandibular lesions using an intraoperative navigation system.

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1. Background

Bone lid surgery involves cutting a window and removing a portion of bone; this portion is subsequently returned to its original position at the end of the surgery [1]. This surgical technique can avoid large bone defects secondary to access osteotomies. It has been used in several clinical treatments in maxillofacial regions to gain access such as to the maxillary sinus [2,3], impacted teeth [4], and jawbone lesions [5]. The ideal treatment is as conservative as possible to preserve alveolar and jaw bones. Thus, it is important to know the precise position of the lesion. However, since lesions in the jawbone are covered in the cortical bone, it is difficult to accurately determine their positions from outside.

Computer-assisted intraoperative navigation has recently evolved to improve precision and simplify the surgical procedure with minimizing the surgical invasiveness. The development of intraoperative navigation surgery has improved its execution and predictability, allowing for a more precise operation in maxillofacial surgery. However, the application of computerized navigation surgery to the mandible is somewhat complicated because of its mobility. Unlike the rest of the

List of abbreviations: CT, computed tomography.

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craniofacial skeleton, because the mandible is an independently movable body, its synchronization with a pre-acquired CT image is difficult.

Here, we report the case of our modified precise bone lid surgery technique for the mandibular lesion that utilizes a computer-assisted intraoperative navigation system.

2. Presentation of case

In June 2016, a 55-year-old Japanese male patient who did not present any noteworthy past medical condition was referred to our division of Kagawa Prefectural Central Hospital by a general dental practitioner because of right mandibular swelling. Clinical examination revealed facial swelling and erythema in the right mandibular region.

A panoramic radiograph revealed the lesion with the impacted premolar tooth in the mandible. The lesion had a large, well-circumscribed radiolucency measuring 17.2×13.4 mm in diameter, surrounding the impacted premolar tooth. A computed tomography (CT) scan confirmed a cystic lesion measuring $17.4 \times 15.2 \times 8.2$ mm in diameter, surrounding the impacted premolar tooth crown and extending to the mental foramen.

After clinical and radiographic examinations, a follicular cyst in the right mandibular was diagnosed. An intraoperative navigation-assisted cystectomy was planned.

3. Technique

We chose to apply 3-dimensional navigation-guided surgery because it is accurate and enables minimally invasiveness. We used a custom interocclusal splint for repeatable mandibular positioning while allowing for surgical access. The splint was fabricated with a dental mold at the first visit. Upper and lower jaw splints were fastened to achieve a stable position of the mandible. A maxillofacial CT scan was then obtained with the splint in place to maintain the mandible in a repeatable position (Figs. 1 and 2). The imaging data were obtained in Digital Imaging and Communication in Medicine format and transferred to a Medtronic StealthStation S7 workstation using Synergy Fusion Cranial 2.2.6 software (Medtronic, Inc., Louisville, Colorado, United States). The patient was taken to the operating room, and the custom interocclusal splint was reinserted during surgery under general anesthesia maintained via nasal intubation. A Patient Tracker EM was affixed to the forehead to act as the reference array to track the navigation probe. To perform patient-to-CT data registration, the navigation instrumentation probe was used to trace the reference array, soft tissue landmarks of the face, and hard tissue points, such as the tooth cusps and incisal edges. After the data registration was complete, continuous 3-dimensional tracking of the navigation probe was available to the surgeon in real time (Fig. 3). This tracking was possible because the mandible was in identical positions during the CT scan and in the operating room because of the use of the interocclusal splint. Using the 3-dimensional location of the navigation probe in relation with the mandibular lesion, a location that best approximated the shape of the lesion in conjunction with the navigation probe was chosen.

A vestibular incision was made at this location. Subperiosteal reflection was done, and the lesion location was carefully confirmed using the navigation system. To allow access to the teeth or lesion, a piezosurgery device was used for the osteotomy to cut a precisely defined bony window in the extended reflection area of the underlying teeth or lesions on the



Fig. 1. Pre-operative panoramic radiograph (A) and computed tomographic scan (B, C). The lesion presented with the reverse of the impacted premolar tooth in the mandible.

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