Comparison of the Effects of Ultrasonic and Conventional Surgery on the Neurosensory Disturbance After Bilateral Sagittal Split Osteotomy

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Purpose: According to the literature, ultrasonic surgery reduces the incidence of neurosensory disturbance (NSD) of the inferior alveolar nerve (IFAN) after bilateral sagittal split osteotomy (BSSO). The purpose of this study was to evaluate the effects of ultrasonic surgery and the anatomic position of the IFAN canal on NSD after BSSO.

Patients and Methods: This retrospective cohort study included skeletal mandibular prognathism cases operated on with an ultrasonic bone scalpel or a reciprocating saw. The primary predictor variable was osteotomy technique (ultrasonic or conventional surgery). The primary outcome variable was NSD. Other variables included age, gender, operator, degree of setback, surgical duration, blood loss, and IFAN position. Comparisons of 2 variables were performed by use of the Student *t* test or Fisher exact test. A regression model was used to examine the relationship between the presence or absence of NSD and other variables. The level of significance was set at $P < .05$ for all statistical tests.

Results: The ultrasonic group was composed of 35 patients, whereas the conventional group was composed of 32. Three months after surgery, NSD was observed on 16 of 70 sides (22.9%) in the ultrasonic group and 28 of 64 sides (43.8%) in the conventional group; this difference was significant. Furthermore, recovery from NSD at 3 months after BSSO was significantly more common in the ultrasonic group than in the conventional group. In the ultrasonic group, even when the distance from the buccal aspect of the IFAN canal to the outer buccal cortical margin was shorter, NSD of the IFAN was less frequent.

Conclusions: Ultrasonic surgery may be an effective technique to reduce the incidence of NSD after BSSO, and it contributed to recovery from NSD. The use of an ultrasonic device for BSSO is recommended when the distance from the buccal aspect of the IFAN canal to the outer buccal cortical margin is shorter on computed tomography.

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Neurosensory disturbance (NSD) of the inferior alveolar nerve (IFAN) is one of the most common complications after bilateral sagittal split osteotomy (BSSO).[1,2] We have shown that the anatomic position of the IFAN canal at the mandibular second molar may be related to the occurrence of NSD of the IFAN after BSSO.[2,3] However, the occurrence of NSD may be affected by other factors, such as mechanical stimulation during osteotomy. The incidence has decreased over the years owing to improved techniques and the use of different instruments.[1,4]

Ultrasonic surgery has recently been introduced in oral and maxillofacial surgery.[5,6] In ultrasonic surgery, osteotomy can be performed by ultrasonic vibration while causing minimal invasion of the soft tissues, such as the blood vessels and nerves.[7,8] Some studies reported that the occurrence of NSD of the IFAN after BSSO can be reduced when BSSO is performed with ultrasonic surgical instruments.[9-11] In contrast, another study concluded that there was no significant difference in the occurrence of NSD after BSSO when using an ultrasonic surgical instrument or a conventional saw.[4]

The purpose of this study was to compare the incidence of NSD after BSSO between ultrasonic and conventional surgery for patients with skeletal mandibular prognathism. We hypothesized that ultrasonic surgery would reduce the occurrence of NSD after BSSO compared with conventional surgery. The specific aims of this study were to determine whether there are correlations between the occurrence of NSD and osteotomy technique (ultrasonic or conventional surgery), age and gender of the patients, operator, procedure duration, blood loss, and anatomic position of the IFAN canal.

Patients and Methods

STUDY DESIGN AND SAMPLE

To address the research purpose, a retrospective cohort study was conducted. The study population was composed of all patients presenting for evaluation and treatment of skeletal mandibular prognathism who underwent BSSO from January 2012 to December 2015 at the Kyushu Dental University Hospital in Japan.

Patients were included in the study sample if they had skeletal mandibular prognathism with a negative overjet before orthodontic treatment, as calculated from lateral cephalometric analysis of radiographic images. Patients were excluded as study participants if they had craniofacial anomalies or syndromes and if they had undergone genioplasty or conjunctive maxillary osteotomy. The research protocol was approved by the Ethics Committee of Kyushu Dental University (14-1-23). All procedures were performed in accordance with the ethical standards of the responsible committee on human experimentation (institutional and national) and with the Helsinki Declaration of 1975, as revised in 2008.

SURGICAL PROCEDURE

All operations were performed by 2 experienced surgeons: surgeon A (I.Y.) and surgeon B (M.H.). The BSSO procedure was performed according to the Epker technique.[12] Cases operated on from 2013 to 2015 using an ultrasonic bone scalpel (Variosurg LED; Nakanishi, Kanuma, Japan) were included in the ultrasonic group, whereas the conventional group consisted of cases from 2011 to 2012 treated using a Lindemann bur, a reciprocating saw, and a bone chisel.

In the ultrasonic group, BSSO was performed using short and long ultrasonic bone scalpels (Fig 1). The scalpels' ultrasonic osteotome operated at a nominal, nonmodulated frequency of 28 to 32 kHz, and the amplitude of the vibrations was 300 μm. The first cut was made through the lingual cortex just above the mandibular foramen using the short ultrasonic bone scalpel (Fig 1). The second corticotomy was made through the buccal cortex in a vertical direction using the short ultrasonic bone scalpel. The third corticotomy connected the first 2 osteotomy lines along the anterior border of the ascending ramus using the short ultrasonic bone scalpel. Cortical bone and cancellous bone were then separated by splitting forceps and the long ultrasonic bone scalpel instead of chisels (Fig 1). A chisel was used only if necessary at the inferior cortical bone between the proximal and distal segments beneath the level of the mandibular canal.

In the conventional group, the lingual and buccal bone cuts were made with a Lindemann bur. The sagittal bone cut was made with a reciprocating

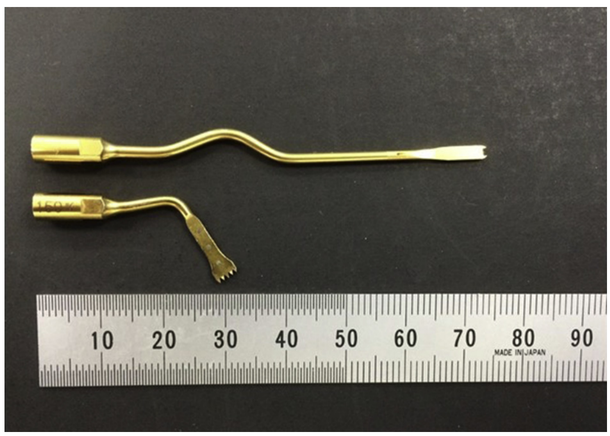

FIGURE 1. Ultrasonic bone scalpels. The horizontal, vertical, and sagittal bone cuts are performed with a short ultrasonic bone scalpel. The cortical bone and cancellous bone are separated by a long ultrasonic bone scalpel.

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