



## Mechanism of transient mental nerve paraesthesia in sagittal split mandibular ramus osteotomy

T. Takeuchi, K. Furusawa, I. Hirose

*Department of Dental Anaesthesiology and Oral and Maxillofacial Surgery, Department II, Matsumoto Dental College, Nagano, Japan*

**SUMMARY.** We investigated the mechanism involved in paraesthesia associated with sagittal split mandibular ramus osteotomy by three-dimensional computed tomography (3-D CT). Ten female patients underwent this procedure between 1988 and 1991. The inferior alveolar neuro-vascular bundles remained intact during the sagittal osteotomy in all cases. We examined the changes in the shape of the foramen mandibulae over a period of 6 months during which the transient mental nerve paraesthesia was recovered, and studied the distance from the foramen mandibulae to the spina mentalis (F-S distance) as measured on 3-D film. The postoperative 3-D CT scan showed bone resorption in front of the foramen mandibulae, and the F-S distance was shortened by an average of 2.94 mm. These findings suggest that possible causes of the paraesthesia is due to compression of the nerve trunk resulting from posterior movement of the mandibular ramus.

### INTRODUCTION

The safety of sagittal split mandibular ramus osteotomy (SSMRO) makes it the most frequently employed surgical method to correct prognathism. However, the operation often results in transient mental nerve paraesthesia.<sup>1</sup> Postoperative paraesthesia is generally considered to be caused by mechanical damage to the sensory fibers of the inferior alveolar nerve. In our experience, paraesthesia occurs even though the nerve remains intact during the operative procedures. The cause of paraesthesia remains unknown. Therefore, we investigated the mechanism of paraesthesia by three-dimensional computed tomography (3-D CT).

### METHODS

Ten female patients who underwent SSMRO between 1988 and 1991. Before the operation, we explained the side effects of radiation during CT scanning to the both patients and their parents, and obtained their consent. The operation was performed according to Dal Pont's<sup>2</sup> modification of the original SSMRO. In all cases, the bone-splitting procedure was performed with a thin spatula alone, and the inferior alveolar neurovascular bundles remained intact during the operation. Bone fixation was achieved with wire osteosynthesis. All operations were performed by the same surgeon, and using hypotension anaesthesia.

The paraesthetic skin area was examined post-operatively by two mechanical stimulation tests (Von Frey Hair and two-point discrimination). Nerve func-

tion was considered to have recovered when sensitivity had returned to the preoperative state.

CT scanning was performed with a TCT60A/EX scanner (Toshiba Medical Co Ltd) at 120 kVp and 250 mA. Five-millimetre thick axial scans parallel to the Frankfort horizontal plane were performed at 5 mm intervals with a scan time of 4 s per slice. The observations were made using 3-D CT image constructed by a 3-D image system (CTD 01B, Toshiba Medical Co Ltd). A medical view provided visualisation of the direction of the foramen mandibulae whose changes were monitored. We examined these changes in the shape of the foramen mandibulae periodically until paraesthesia disappeared. We examined the correlation between the change of the distances from the foramen mandibulae, and measured the distances from the spina mentalis (F-S distance) and the amount of surgical retraction in the corpus mandibulae on a CT image using the self-contained system of the CT scanner. The measurement points were determined from the shortest F-S distance. The measured distance was the difference in F-S distance obtained by subtracting the postoperative one after which the correlation between the difference in F-S distance and amount of mandibular retraction was examined.

### RESULTS

The mean age at the time of surgery was 18 years, ranging from 16 to 20 years. Blood loss during surgery was between 115 ml and 385 ml, and the mean duration of surgery was 3 h and 16 min. We evaluated sensory disturbance of 20 mental regions innervated by the mental nerve in 10 patients.

Postoperative paraesthesia in the area occurred in 80% of the cases, but it disappeared within an average of  $179 \pm 75$  days postoperatively (Table 1). The shape of the foramen mandibulae had changed from the preoperative V-shape to a U-shape by the time mental nerve function had recovered 3-D CT photographs (Fig. 1). Eventually, total bone resorption was observed on the front of the foramen mandibulae (posterior margin of the lingula mandibulae). The average amount of mandibular retraction was  $6.8 \pm 3.2$  mm ( $n=20$ ). The postoperative F-S distance was shortened by an average of  $3.3 \pm 2.0$  mm ( $n=20$ ), while it was shortened by an average of  $3.9 \pm 1.8$  mm ( $n=16$ ) when the cases in which there was no change in the foramen mandibulae were excluded (Fig. 2, Table 2). There was a positive correlation between the difference of the F-S distance to

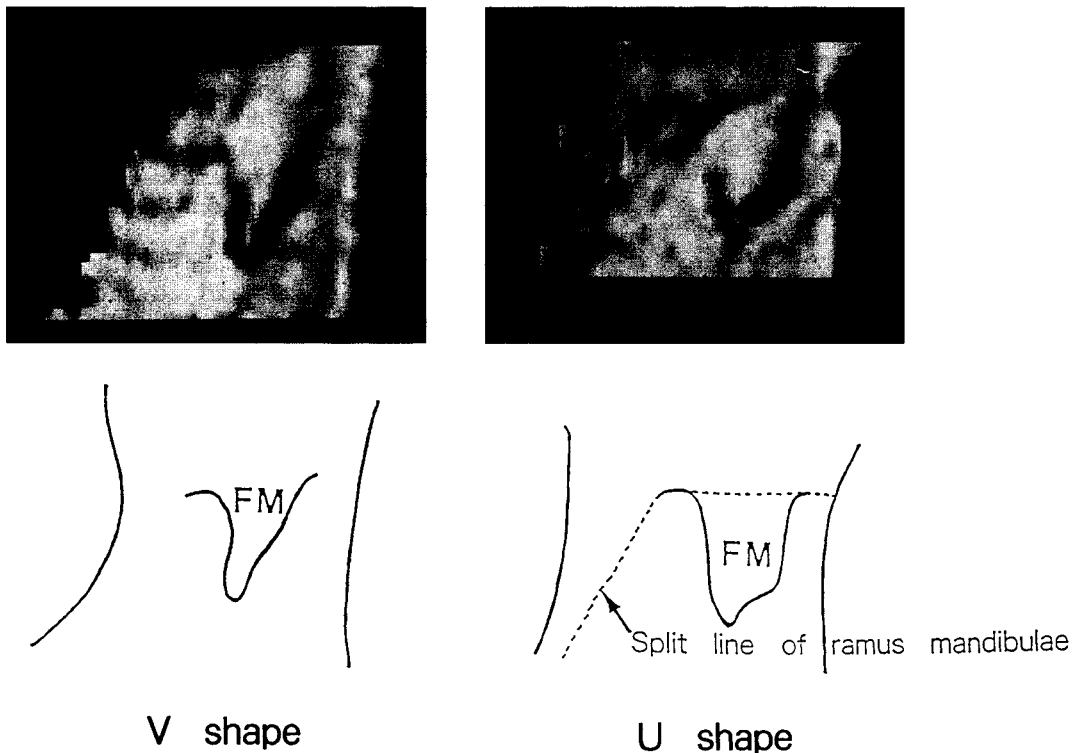
the extent of posterior transfer of the corpus mandibulae ( $p < 0.02$ , Fig. 3).

**DISCUSSION**

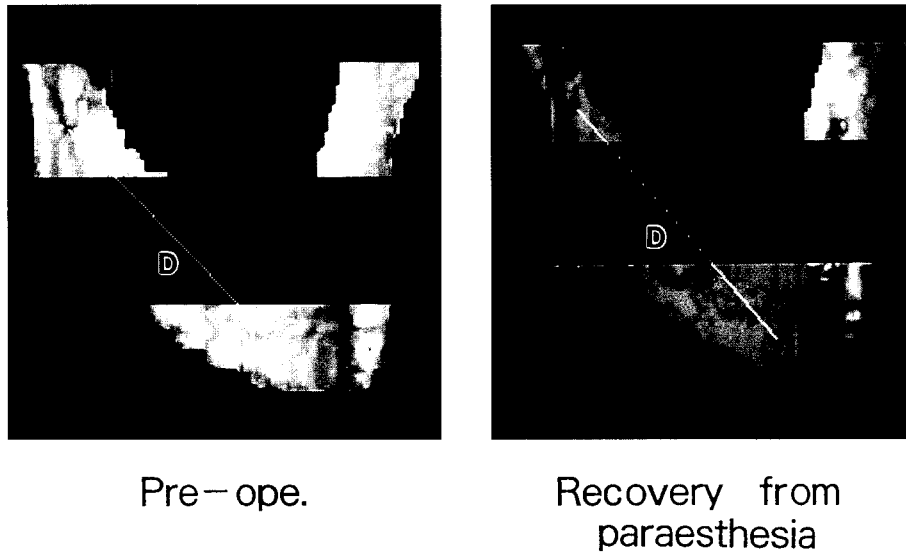
The mechanism of inferior alveolar and mental nerve paraesthesia after SSMRO can be divided into two categories: indirect damage to the nerve by postoperative oedema or haematoma, and direct damage to the nerve which occurs during the sagittal osteotomy or as a result of exposure to air. The responses of the sensory fibers of the inferior alveolar nerve disappear 24–48 h postoperatively due to the development of postoperative oedema in the mandibular canal.<sup>3</sup> The impairment of the nerve was noted to occur with exposure to air, and its recovery was observed within

**Table 1** – Profiles of subjects

Case no.	Age (years)	Duration of operation	Blood loss (ml)	Mental nerve paraesthesia	Recovery course (days)	
					Right	Left
1	16	3H15M	385	Right side	102	—
2	20	2H55M	115	None	—	—
3	20	3H10M	295	Bilateral	216	185
4	17	3H35M	350	Bilateral	146	146
5	18	3H10M	136	Bilateral	177	177
6	16	3H00M	315	Bilateral	72	145
7	16	3H05M	360	Bilateral	111	95
8	19	3H25M	256	Bilateral	325	340
9	18	3H10M	189	Left side	—	211
10	20	3H50M	359	Bilateral	204	204



**Fig. 1** – Change in shape of the foramen mandibulae on the medial 3-D CT photographs. The shape of the foramen mandibulae had been transformed from the preoperative V shape to a U shape by the time the mental nerve paraesthesia was restored to its preoperative status. FM: foramen mandibulae.

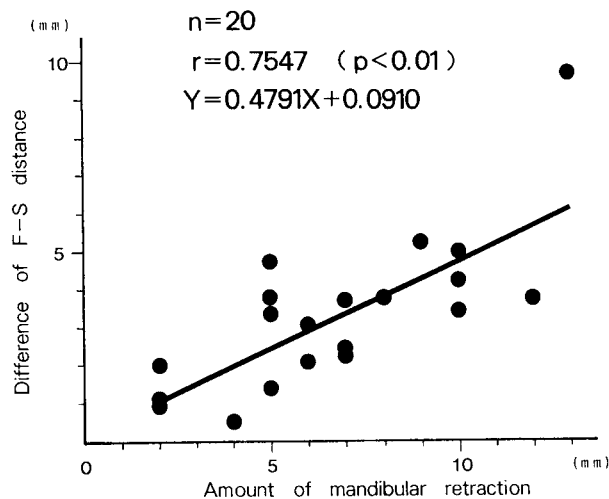


**Fig. 2** -- Measurement of the shortest distance from the foramen mandibulae to the spina mentalis (F-S distance) on 3-D CT. D: F-S distance.

**Table 2** -- The amount of mandibular retraction and difference of F-S distance

Case no.	Left side			Right side		
	Amount of mandibular retraction (mm)	Difference of F-S distance (mm)	Change of foramen mandibulae	Amount of mandibular retraction (mm)	Difference of F-S distance (mm)	Change of foramen mandibulae
1	2.0	1.0	None	7.0	3.7	+
2	5.0	1.4	None	4.0	0.5	None
3	7.0	2.4	+	5.0	3.3	+
4	10.0	4.2	+	10.0	3.4	+
5	12.0	3.8	+	9.0	5.2	+
6	2.0	1.9	+	10.0	5.0	+
7	6.0	3.1	+	5.0	3.8	+
8	7.0	2.3	+	6.0	2.1	+
9	5.0	4.7	+	2.0	1.1	None
10	13.0	9.7	+	8.0	3.9	+

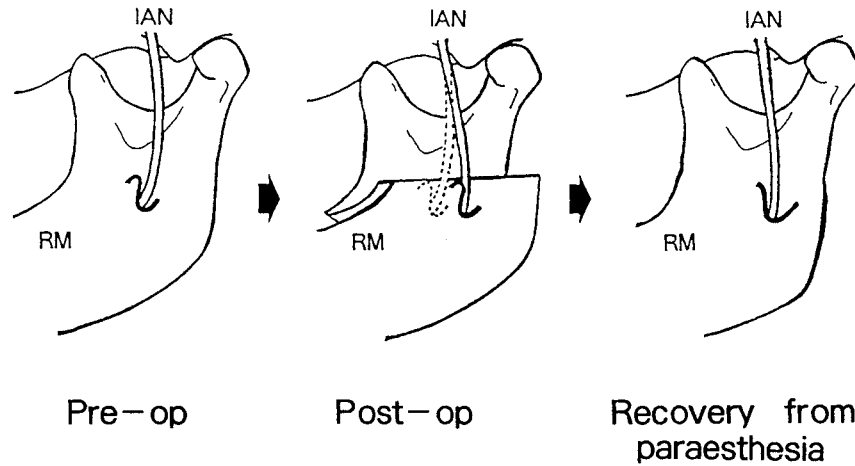
The cross sign (+): changes of the foramen mandibulae detected by macroscopic observations.



**Fig. 3** -- Correlation of mandibular retraction to difference of F-S distance.

8 weeks.<sup>4</sup> Paraesthesia due to either local oedema, haematoma or exposure to air during the sagittal osteotomy procedure may not necessary prolong the course of recovery. The mental paraesthesia in our patients disappeared on an average of  $179 \pm 75$  days postoperatively. Thus, neither direct or indirect nerve damage was considered to have occurred in our patients. On the other hand, while direct damage to the inferior alveolar nerve could be caused by the instruments used in bone splitting, special care was taken when operating around the nerve so that these instruments did not by themselves cause direct damage. When direct mechanical damage to the nerve (neurotmesis) is induced, complete recovery of the sensory fibers may be difficult.<sup>1</sup> However, most surgeons reported a very low incidence of long-term problems.<sup>5</sup>

Evaluation of pre- and postoperative 3-D CT images, revealed that the paraesthesia recovery was related to the bone absorption on the front of the foramen mandibulae, and shortening of F-S distance



**Fig. 4** – Schema of the mechanism of transient mental nerve paraesthesia. Postoperative (Post-op.) mental nerve paraesthesia resulted from the compression of the inferior alveolar nerve by the foramen mandibulae with posterior transfer of the corpus mandibulae, and it recovered by changes occurring in the foramen mandibulae (the bone absorption on the front of the foramen mandibulae). IAN: inferior alveolar nerve. RM: ramus mandibulae.

was related to the posterior transfer of the corpus mandibulae. These changes are not thought to be due to the operation. Our findings indicate that the bone absorption on the front of the foramen mandibulae appeared to be caused by the compression of the inferior alveolar nerve by the foramen mandibulae, with posterior transfer of the corpus mandibulae. As a result, one of the possible causes of sensory loss to the mental nerve is due to the compression of the inferior alveolar nerve, and the recovery from such sensory disturbances may be accomplished by opening of the foramen mandibulae (Fig. 4).

**References**

1. Martis CS. Complications after mandibular sagittal split osteotomy. *J Oral Maxillofac Surg* 1984; 42: 101.
2. Dal Pont G. Retromolar osteotomy for the correction of prognathism. *J Oral Surg* 1961; 19: 42.
3. Freihofer Jr HPM, Petresevic D. Late results after advancing the mandibular by sagittal splitting of the rami. *Journal of Maxillo-Facial Surgery* 1975; 3: 250.

4. Matsuda Y. Effect of Nerve Injuries on action potential of inferior alveolar nerve. *Sikagakuhou* 1980; 80: 1267.
5. Behrman SJ. Complications of sagittal osteotomy of the mandibular ramus. *J Oral Surg* 1972; 30: 554.

**The Authors**

**K. Furusawa DDS, PhD**  
 Lecturer  
 Oral and Maxillofacial Surgery Department II  
**T. Takeuchi DDS PhD**  
 Assistant Professor  
**I. Hirose DDS, PhD**  
 Professor and Chairman  
 Department of Dental Anaesthesiology  
 Matsumoto Dental College  
 Shiojiri, Nagano 399-07  
 Japan

Correspondence and requests for offprints to T. Takeuchi

Paper received 14 January 1993  
 Accepted 26 July 1993