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Combined preoperative measurement of three inferior alveolar canal factors using computed tomography predicts the risk of inferior alveolar nerve injury during lower third molar extraction

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Abstract. A retrospective cohort study was performed to assess the clinical usefulness of combination assessment using computed tomography (CT) images in patients undergoing third molar extraction. This study included 85 patients (124 extraction sites). The relationship between cortication status, buccolingual position, and shape of the inferior alveolar canal (IAC) on CT images and the incidence of inferior alveolar nerve (IAN) injury after third molar extraction was evaluated. IAN injury was observed at eight of the 124 sites (6.5%), and in five of 19 sites (26.3%) in which cortication was absent + the IAC had a lingual position + the IAC had a dumbbell shape. Significant relationships were found between IAN injury and the three IAC factors (cortication status, IAC position, and IAC shape; $P = 0.0001$). In patients with the three IAC factors, logistic regression analysis indicated a strong association between these factors and IAN injury ($P = 0.007$). An absence of cortication, a lingually positioned IAC, and a dumbbell-shaped IAC are considered to indicate a high risk of IAN injury according to the logistic regression analysis ($P = 0.007$). These results suggest that a combined assessment of these three IAC factors could be useful for the improved prediction of IAN injury.

Key words: lower third molar; extraction; computed tomography; inferior alveolar nerve; inferior alveolar canal; paresthesia.

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Extraction of the lower third molar (LM3) is a commonly performed procedure in oral surgery[1]. However, injury to the inferior alveolar nerve (IAN) often occurs as a complication of mandibular third molar extraction, with a frequency ranging from 0.5% to 8%[2,3]. Therefore, a reduction in the risk of IAN injury is the most important issue associated with LM3 extraction.

Paresthesia of the IAN has been associated with factors such as age, sex, type of anaesthesia, and the experience of the surgeon[4–7]. However, several studies have reported the predictive value of computed tomography (CT) assessment for IAN injuries[8–12]. On the basis of these studies, the combined assessment of three factors, namely the absence of cortication between the inferior alveolar canal (IAC) and the LM3[11,13–16], the shape of the IAC[13–16], and the position of the IAC on CT Images[12], could reliably improve the prediction of IAN injury (Fig. 1). Moreover, combination assessment using these factors could predict IAN injury with greater accuracy.

The specific aim of this study was to clarify the clinical usefulness of such a combination assessment using CT images for LM3 extraction in those patients for whom panoramic radiography has identified known risk factors.

Materials and methods

Study design and sample

This retrospective cohort study included 85 consecutive patients who presented to the Department of Oral and Maxillofacial Surgery, University Hospital of Toyama (Toyama, Japan) for the management of lower third molars, between January 2012 and December 2013. Forty-seven of these patients were male and 38 were female, and their mean age was 31.46 years (range 17–90 years).

The extraction of the LM3 was performed under general or local anaesthesia by various surgeons. The criterion for inclusion in the study sample was the presence of a close relationship between the LM3 and the IAC on panoramic radiographs. The 85 patients (124 LM3) underwent a CT examination following panoramic radiography to allow the anatomical relationship to be studied in greater detail. The CT images were obtained using a Somatom Definition AS+ 128-slice CT machine (Siemens Germany Ltd, Munich, Germany). Axial sections were acquired with the plane of data acquisition parallel to the hard palate, with a slice thickness of 3 mm, and reconstructions at 0.75 mm in the coronal and sagittal planes. The scanning parameters were 190 mAs, 120 kV, and tube rotation time of 0.5 s.

Patients were excluded from the study if they had another impacted tooth to be extracted (e.g., an impacted premolar), a

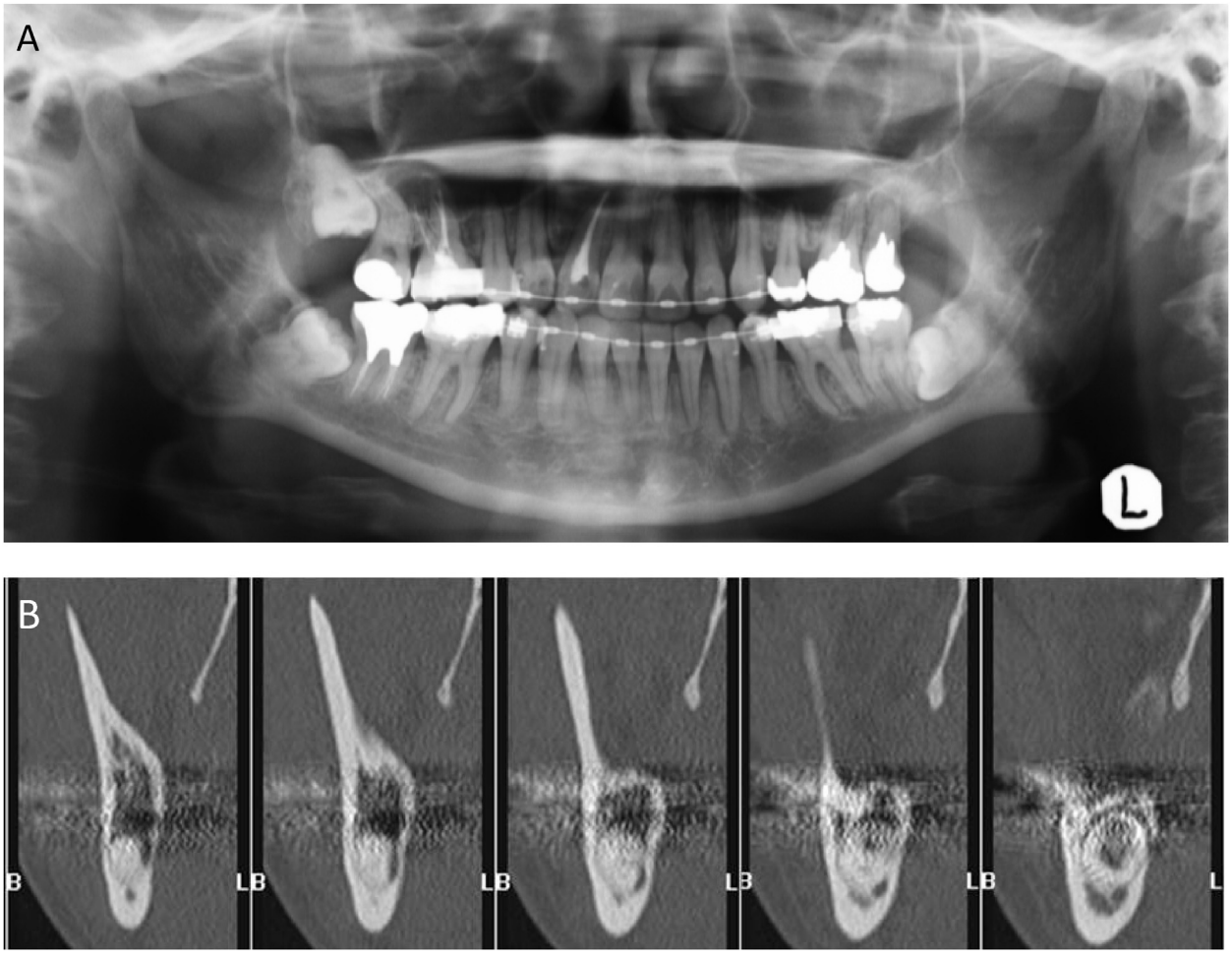

Fig. 1. (A) Representative panoramic radiograph showing an overlap of the right lower third molar and the inferior alveolar canal (IAC). (B) Representative computed tomography images demonstrating the absence of cortication between the IAC and the lower third molar, the shape of the IAC, and the position of the IAC.