



Brief Report

A comparison of direct laryngoscopic views in different head and neck positions in edentulous patients



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ABSTRACT

Objective: Proper head and neck positioning is an important factor for successful direct laryngoscopy, and the optimum position in edentulous patients is unclear. We compared direct laryngoscopic views in simple head extension, sniffing, and elevated sniffing positions in edentulous patients.

Methods: Eighteen adult edentulous patients scheduled for elective surgery were included in the study. After induction of anesthesia, the laryngeal view was assessed under direct laryngoscopy using the percentage of glottic opening (POGO) score in 3 different head and neck positions in a randomized order: simple head extension without a pillow, sniffing position with a pillow of 7 cm, and elevated sniffing position with a pillow of 10 cm. After assessment of the laryngeal views, tracheal intubation was performed.

Results: A significant difference was observed in the laryngeal views assessed at the 3 head positions ($P = .001$). The POGO scores (mean [SD]) in the sniffing position (78.9% [19.7%]) and elevated sniffing position (72.6% [20.8%]) were significantly improved compared to that with simple head extension (53.8% [25.9%]) ($P = .001$, respectively). The sniffing position provided the best laryngeal view. The mean POGO scores were higher in the sniffing position than the elevated sniffing position, but no significant difference was observed between these 2 positions ($P = .268$).

Conclusions: The sniffing and elevated sniffing positions provide better laryngeal views during direct laryngoscopy compared to simple head extension in edentulous patients.

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1. Introduction

Direct laryngoscopy is a standard technique for tracheal intubation, and optimal laryngeal exposure is important for successful tracheal intubation during direct laryngoscopy. Particularly, it is crucial to achieve the best laryngeal view promptly for successful emergency airway management. The sniffing position, defined as neck flexion with upper cervical extension, has been recommended to achieve a good laryngeal view for direct laryngoscopy and tracheal intubation [1]. However, Adnet et al [2] showed that routine use of the sniffing position had no significant advantage over simple head extension for tracheal intubation except in obese and head extension-limited patients.

Optimal head and neck position for direct laryngoscopy has been studied commonly in patients with normal dentition. Dental condition also affects direct laryngoscopy. Prominent upper incisors or canines can impose a limitation on the line of vision. The edentulous state is considered to be easier for achieving a better line of vision [3] but has been

also suggested to make it more difficult for the laryngoscopist to view the larynx and pharynx [4]. Moreover, edentulism leads to reduction of the retropharyngeal space after anatomical changes, including a decrease in the vertical dimension and collapse of orofacial structures [5], which may affect direct laryngoscopy. Thus, the laryngeal view during direct laryngoscopy in edentulous patients may be different in the same head position compared to patients with normal dentition. However, the optimal head position for direct laryngoscopy in edentulous patients has not been determined yet. In the present study, we compared laryngeal views in the simple head extension, sniffing, and elevated sniffing positions during direct laryngoscopy in edentulous patients.

2. Methods

The present study was designed as a randomized, 3-arm, 3-period open-label, cross-over trial and was approved by our medical center (no. 20150122/16-2015-18/021). Written informed consent was obtained from all patients. The trial was registered at the Clinical Research Information Service (KCT0001484).

Adult edentulous patients scheduled for elective surgery requiring tracheal intubation were enrolled in the study. Patients were excluded

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if they had a known or predicted difficult airway; diseases or anatomical abnormalities in the neck, larynx, or pharynx; or body mass index greater than or equal to 30 kg/cm² or were at risk for aspiration. Preoperative airway assessment included the following criteria: (1) modified Mallampati score (scores of 3 or 4 were considered to indicate difficult intubation [6]); (2) thyromental distance, a straight line from the thyroid notch to the lower border of the mandibular mentum with the head fully extended (a value <65 mm was considered to indicate difficult intubation); (3) mouth opening, the gap between the upper and lower gums with the mouth fully opened (originally, a value of interincisor gap <35 mm was considered to predict intubation difficulty, and we considered a gap between the upper and lower gums of <35 mm as difficult intubation); (4) body mass index; and (5) range of neck motion, the amplitude of head and neck movement classified as less than 80° or greater than 80°, as described by Wilson et al [7].

No premedication was administered to the patients. Intraoperative monitoring included electrocardiogram, pulse oximetry, gas analyzer, and noninvasive arterial pressure monitoring. Anesthesia was induced using propofol 1.5 mg/kg and fentanyl 1.5 to 2.0 µg/kg, and rocuronium 0.6 mg/kg was administered to achieve maximum neuromuscular blockade.

Patients were randomized to 1 of 6 treatment sequences based on an orthogonal Latin square design. The treatment sequences were ABC, BCA, CAB, ACB, BAC, and CBA, where A, B, and C implied any of the 3 head positions. Randomization was based on a computer-generated program, and the randomization sequence was kept in opaque and sealed envelopes. An investigator who was not involved in the study determined the order of head positions by opening the envelope in sequence. An experienced board-certified anesthesiologist performed all laryngoscopies with a curved blade (in men; a Macintosh blade 4, in women; a Macintosh blade 3). During direct laryngoscopy, the height of the operating table was at the same level as the investigator's anterior superior iliac crest. The laryngeal view was assessed in 3 different positions in random order: (1) simple head extension—head extension without a pillow; (2) sniffing position—head extension with an uncompressible pillow of 7 cm; and (3) elevated sniffing position—head extension with an uncompressible pillow of 10 cm. Patients' head positions were arranged in random order by assistants. The best laryngeal view was assessed in each head position without external laryngeal manipulation using the validated percentage of glottis opening (POGO) score (from 0% to 100%). A POGO score of 100% corresponds to full visualization of the larynx from the interarytenoid notch to the anterior commissure of the vocal cords, and a POGO score of 0% means no visualization of the glottic opening [8]. If required, intermittent manual ventilation by facial mask was performed with 100% oxygen and sevoflurane to prevent desaturation. After the assessment of laryngeal views, tracheal intubation was performed.

The primary outcome was the best laryngeal view, assessed by the POGO score, in the different head positions during direct laryngoscopy. The sample size was determined based on the results of a pilot study. When the minimum mean POGO score difference in laryngoscopic view between simple head extension and the other positions was assumed to be 22% (15%) (mean [SD]), a minimum of 10 subjects would be required to achieve 90% power at the 2.5% level of significance. Because subjects would be randomly assigned to 1 of 6 sequences in an orthogonal Latin square cross-over design, a total of 12 subjects (multiples of 6) were required. To compensate for potential dropouts, 18 subjects were included. SPSS for Windows software (version 20; IBM Corp, Armonk, NY) was used to conduct statistical analyses. Categorical and continuous data are expressed as frequencies (percentages) and means (SD), respectively. Based on the results of the pilot study, the primary hypothesis in this study was that there would be a significant difference in POGO score between simple head extension and each of the other head positions. Repeated-measures analysis of variance was used to analyze multiple measured laryngeal views from the same subject at different head positions. $P < .05$ was taken to indicate statistical significance. Post hoc analysis with the Bonferroni method was

Table
Patient characteristics

Patients (n)	18
Age (y)	75 (8)
Sex (M/F)	10/8
Height (cm)	157.7 (7.6)
Weight (kg)	58.3 (7.7)
Mallampati score (I/II)	10/8
Mouth opening (cm)	4.5 (0.8)
Thyromental distance (cm)	7.3 (0.8)
Range of neck motion (≥80°/≤80°)	18/0

Values are expressed as means (SD) or number of patients.

performed to compare the laryngeal view between simple head extension and each of the other head positions, and $P < .025$ was considered significant.

3. Results

Twenty-three edentulous patients were recruited from April to November 2015. Five patients did not meet the inclusion criteria, and 18 patients completed the study and were analyzed.

Patients' characteristics and preoperative airway assessments are presented in the Table. The laryngeal views in different head and neck positions are shown in Fig 1. A significant difference was observed in the laryngeal views assessed at the 3 head and neck positions ($P = .001$). The POGO scores (mean [SD]) in the sniffing position (78.9% [19.7%]) and elevated sniffing position (72.6% [20.8%]) were significantly improved compared to that in the simple head extension position (53.8% [25.9%]) ($P = .001$, respectively). In the sniffing position, 14 patients (77.8%) had the same or higher POGO scores, and 4 patients (22.2%) had lower POGO scores compared to the elevated sniffing position. The mean POGO scores were higher in the sniffing position than the elevated sniffing position, but no significant difference was observed between these 2 positions ($P = .268$).

During the evaluation of laryngoscopic views, none of the patients experienced hypoxia. After the assessment, tracheal intubation was performed successfully in all patients.

4. Discussion

This study showed that the sniffing and elevated sniffing positions provide better laryngeal views during direct laryngoscopy in edentulous patients.

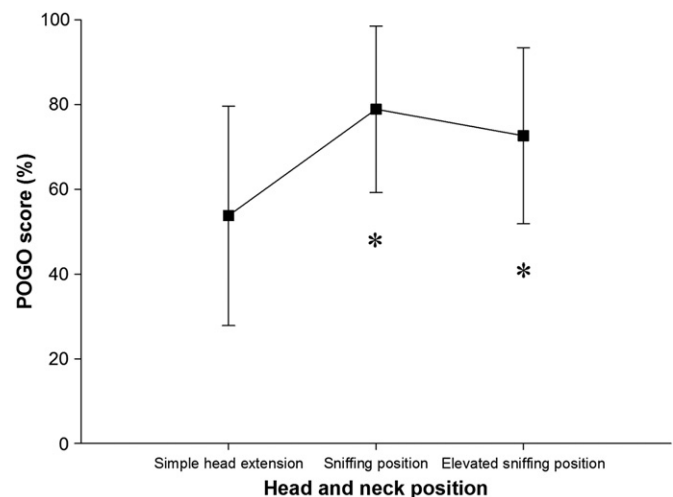


Fig. 1. Percentage of glottic opening score at 3 different head and neck positions. Values are expressed as means (SD). * $P < .05$ compared with simple head extension.

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