

Comparison of Cervical Spine Movement using the AirTraq® Optical Scope versus Macintosh Blade : A Fluoroscopic Randomized Controlled Trial

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Figure 1: AirTraq Optical Laryngoscope

INTRODUCTION

Intubation is frequently required for trauma patients (1) or for patients with unstable C-spine requiring surgery (2). Where the status of the cervical spine is unknown or unstable, there is the potential for spinal cord damage during ventilation or intubation (1-3). The AirTraq indirect laryngoscope (Figure 1) can be used in place of the Macintosh blade for laryngoscopy. (ProMedic Inc, Bonita Springs, FL, USA)

This subject has been well reviewed by Crosby, summarizing the findings for many airway management modalities(2). Our previous study (4) showed that C-spine motion during careful bag-mask ventilation was ~80% less than during direct laryngoscopy with Macintosh blade. Thus the choice of intubating technique is germane.

Hirabayashi (5) showed reduced C-Spine movement using the AirTraq on women, but the study examined only one point in time for each modality and made no attempt at manual in-line stabilization (1). Maharaj (6) showed AirTraq use to be at least as rapid as Macintosh.

This prospective randomized controlled trial compared C-spine movement during laryngoscopy with the AirTraq to direct laryngoscopy with Macintosh 3 blade, using continuous fluoroscopic video to determine the maximal angular displacement of the vertebrae. The secondary endpoint was time taken to accomplish laryngoscopy.

METHODS

Figure 2: cross-over study protocol (4). The null hypothesis was that C-spine movement during intubation with the AirTraq would not differ from direct Macintosh laryngoscopy.

Inclusion criteria:

- Elective ASA physical status I-III patients, Age 18-75
- General anesthesia requiring endotracheal intubation.

Exclusion criteria:

- Gastro-Esophageal Reflux Disease or BMI > 35 kg/m²
- Possibility of pregnancy
- Previous neck surgery, unstable C-spine, or diff airway.

Cross-over Study Protocol

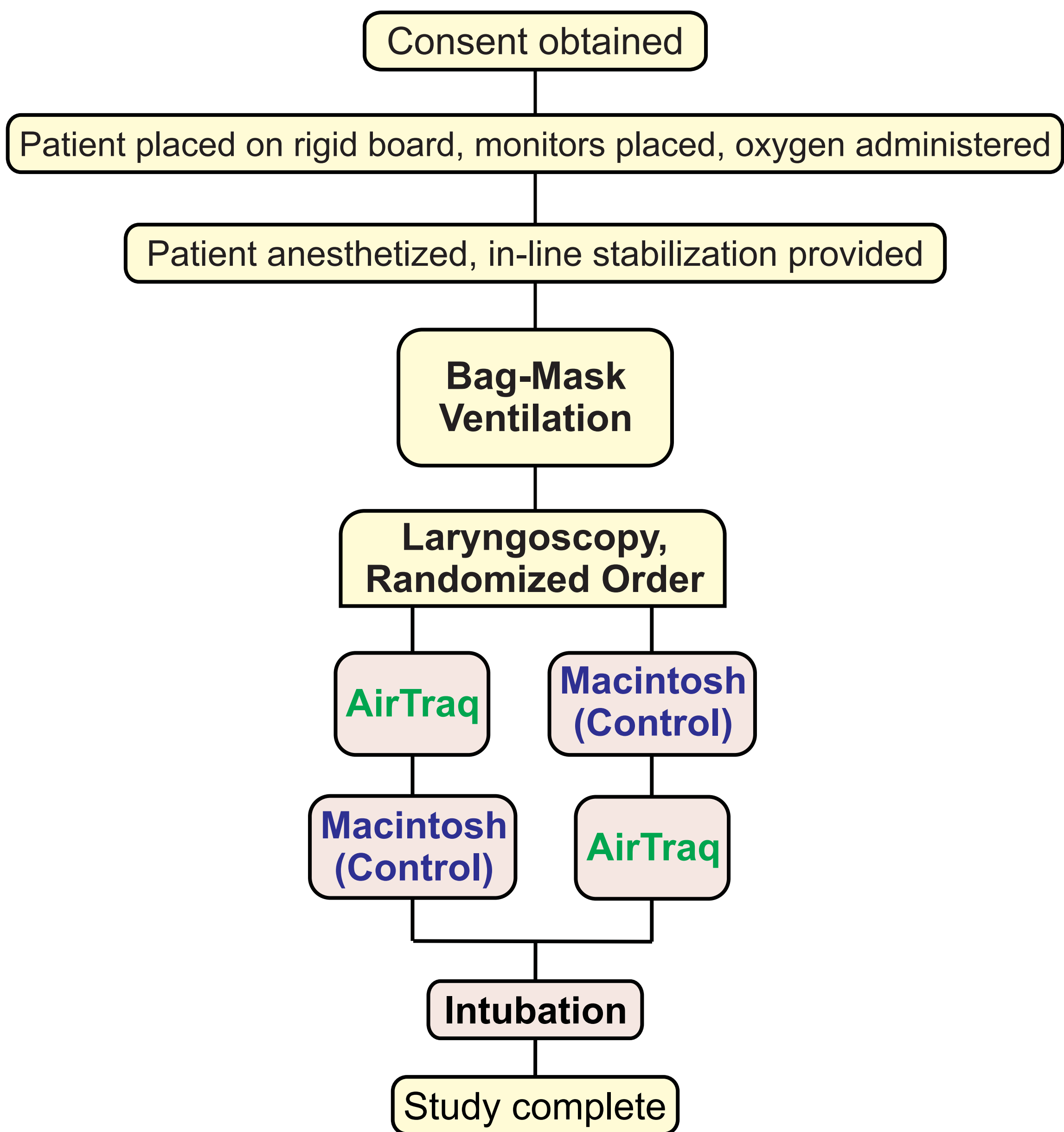


Figure 2: Cross-over Study Protocol. Shaded boxes denote digital fluoroscopy, recorded during Laryngoscopy and Intubation.

Using previous data (4) and a presumed 15% reduction, sample size was estimated to be 10 patients for each group, (p = 0.05, power 0.80). We studied 24 patients.

Manual in-line stabilization (1) was provided by an assistant. Patients were ventilated via bag and mask, attempting to minimize movement with a low threshold for airway use.

Sealed computer-generated random assignment to:

- Group 1 - Direct Macintosh laryngoscopy and then AirTraq use
- Group 2 - AirTraq use and then direct Macintosh laryngoscopy.

Laryngoscopy order was randomized to prevent information obtained by the operator during the first technique from consistently influencing the second technique.

Patients underwent laryngoscopy using *both* techniques; intubation was completed as part of the second laryngoscopy.

To minimize inter-operator variability, all laryngoscopy was performed by one operator (TT).

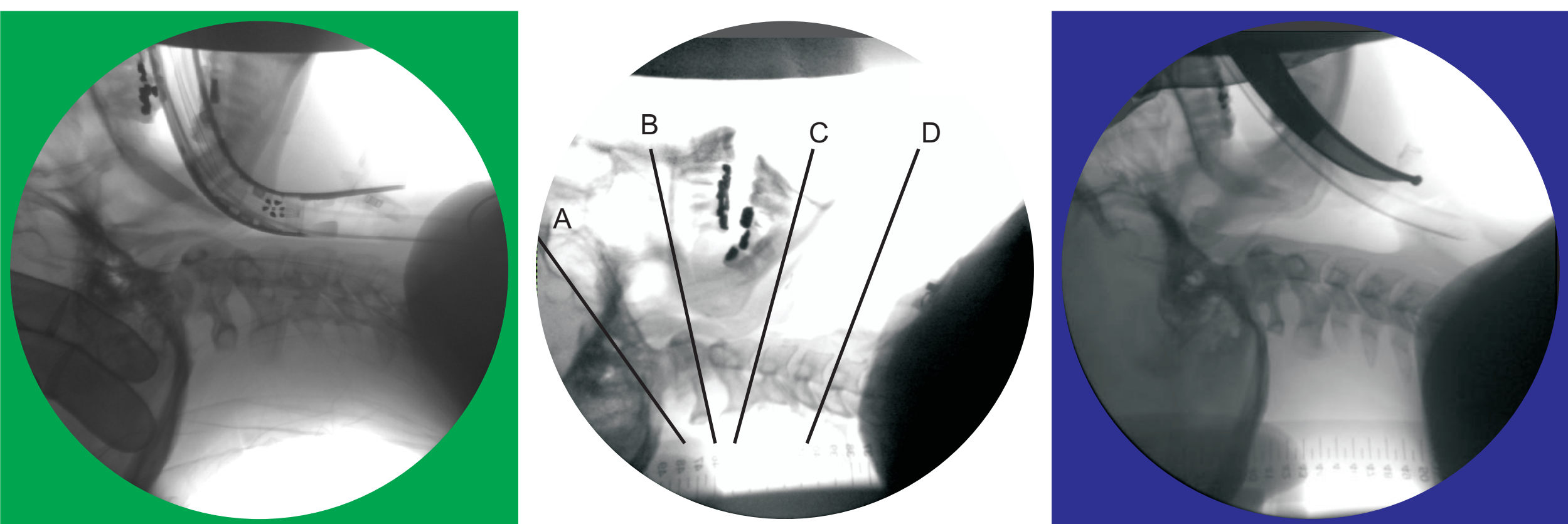


Figure 3: Reference points used to define the angles of each motion segment.

DATA ANALYSES

The absolute rotation (in global coordinates) of each cervical vertebra was not the focus, but rather the relative motion of each component relative to the adjacent components. (OR table rotation would result in “extension” of all components, but no extension relative to one another, and no real C-spine motion.) Motion segments analyzed were Occiput-C1; C1-C2; C2-C5; and C5-Th (7).

Two reference points were selected on each of the vertebra to define the angle of each motion segment (Figure 3). Viewing the sequence on a frame-by-frame basis, the maximum change from the baseline was determined.

Laryngoscopy duration was defined from when the blade or stylet passed the central incisors to when the endotracheal tube was positioned at the vocal cords. If the intubation sequence took longer than 120 seconds, it was deemed a failure.

C-Spine Movement

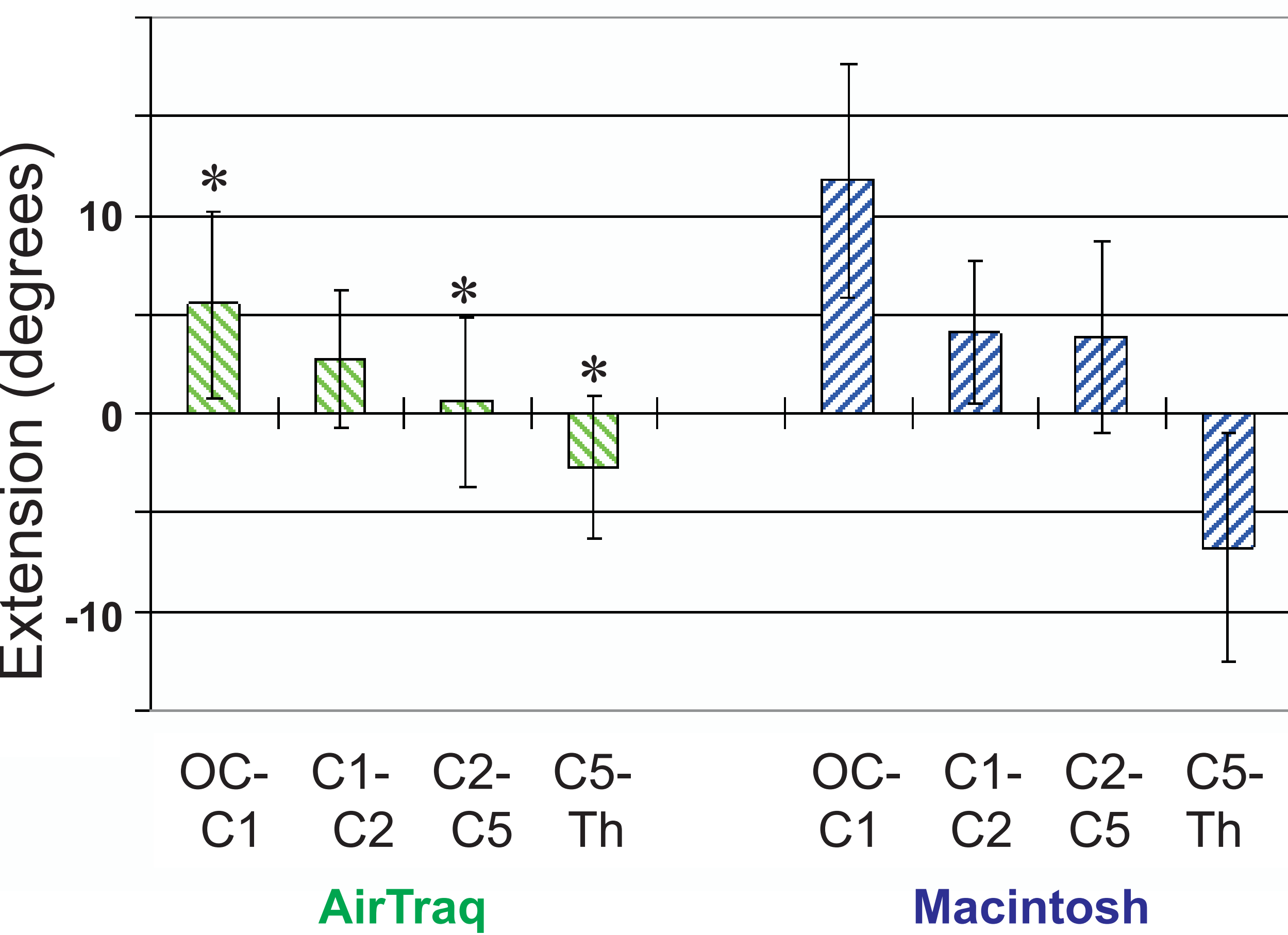


Figure 4: C-Spine movement at 4 motion segments for AirTraq and Macintosh Laryngoscopy, * - p < 0.02 Oc = Occiput, Th = Thoracic vertebra.

Duration of Intubation

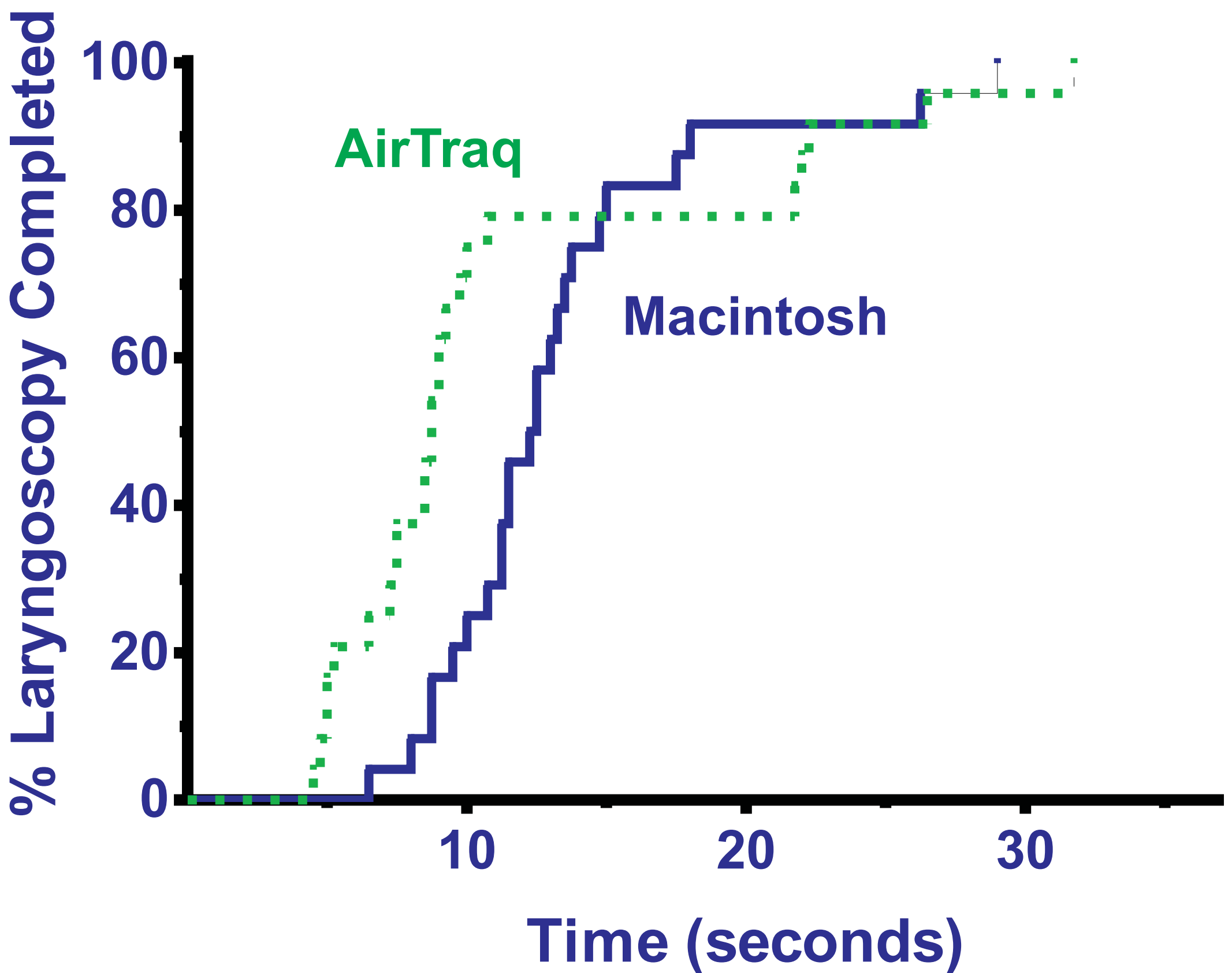


Figure 5: Percentage patients intubated versus Time using AirTraq and Macintosh Laryngoscopy.

RESULTS AND DISCUSSION

There were no failures and no desaturations.

Cervical Spine Movement during Laryngoscopy

The movement of the C-spine at the four segments studied is shown in Figure 4.

C-Spine motion during use of the AirTraq was 39%, 84%, and 42% less at the Occiput-C1, C2-C5, and C5-Thoracic motion segments respectively, p < 0.02. *There was no significant difference in CSpine movement at the C1-C2 segment.* The AirTraq may be a useful tool to experienced users in the setting of “uncleared” Cspine patients, particularly if an injury is suspected in the Occiput-C1 or C2-C5 areas of the Cspine or below C5.

Laryngoscopy Duration

Figure 5 shows a Kaplan-Meier plot illustrating the percentage of patients intubated versus time. Laryngoscopy with AirTraq took 8.8 seconds (IQR 6.7-10.6 s), faster than that with Macintosh blade, (12.4 s IQR 10.2-14.5 s) p < 0.01. The clinical relevance of this difference in intubation duration is minimal.

CONCLUSIONS

C-spine motion was reduced 58% using the AirTraq laryngoscope as compared to the Macintosh blade at the Occiput-C1, C2-C5, and C5-Thoracic segments, in the setting of manual in-line stabilization. There was no difference at the C1-C2 segment.

There was **no** clinically significant difference in duration of intubation.

For patients in whom C-spine movement is undesirable, use of the AirTraq may be advantageous to the experienced user.

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