



## Clinical Study

## Does plate profile affect postoperative dysphagia following anterior cervical spine surgery?

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## ABSTRACT

Dysphagia following anterior cervical spine surgery is a significant problem. The risk factors for such dysphagia have not been established. We examined whether plate profile affected the incidence of dysphagia. This study enrolled 50 consecutive patients undergoing one-level corpectomy or one- or two-level discectomies with plate fixation performed by the same surgeon from 2004 to 2009. The anterior cervical plates used were either the Codman (Johnson and Johnson Professional Inc., Raynham, MA, USA; width 17.58 mm, thickness 2.69 mm; 27 patients) or the Zephir (Medtronic Sofamor Danek Inc., Memphis, TN, USA; width 15 mm, thickness 1.6 mm; 23 patients). Dysphagia was assessed via telephone interviews, and was classified as short-term (occurring within 6 months postoperatively) or persistent (persisting beyond 6 months postoperatively). The overall short-term and persistent dysphagia rates were 20% and 14%, respectively. The short-term and persistent dysphagia rates were 26% and 13% for the Zephir plate, and 14.8% and 14.8% for the Codman plate, and analysis showed that the rates were similar for both types of plate. Age and sex were not found to correlate with dysphagia. In patients undergoing anterior cervical spine surgery with plate fixation, we found that postoperative dysphagia did not correlate with plate profile up to a plate size of 17.58 mm wide and 2.69 mm thick. Dysphagia occurred at the same incidence in patients with a smaller plate that was 15 mm wide and 1.6 mm thick.

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## 1. Introduction

Dysphagia can occur as an acute or delayed complication after anterior cervical spine surgery. Proposed risk factors for the development of postoperative dysphagia include injury to nerves involved in swallowing, postoperative prevertebral edema, scar formation, esophageal injury,<sup>1–4</sup> the use of plate fixation,<sup>5–8</sup> plate prominence,<sup>9,10</sup> age,<sup>11</sup> sex,<sup>5,6,12,13</sup> revision surgery,<sup>6</sup> and multiple-level fusion.<sup>5–7</sup> A number of strategies have been proposed for reducing the risk of developing dysphagia, including the use of perioperative methylprednisolone,<sup>14</sup> endotracheal tube cuff pressure monitoring,<sup>13</sup> and the use of a low profile plate.<sup>9,10</sup>

Debate continues as to whether the plate profile affects postoperative dysphagia. One study<sup>10</sup> reported that a larger and less smooth plate increased the risk of postoperative dysphagia while another found that plate prominence did not increase the risk.<sup>9</sup>

The present study investigated whether plate profile affected postoperative dysphagia in patients undergoing anterior cervical spine surgery. We investigated both transient and persistent dys-

phagia in patients following the use of the Zephir (Medtronic Sofamor Danek Inc., Memphis, TN, USA) anterior cervical plates, and the larger Codman (Johnson and Johnson Professional Inc., Raynham, MA, USA) anterior cervical plates. We also examined whether dysphagia was associated with age or sex.

## 2. Materials and methods

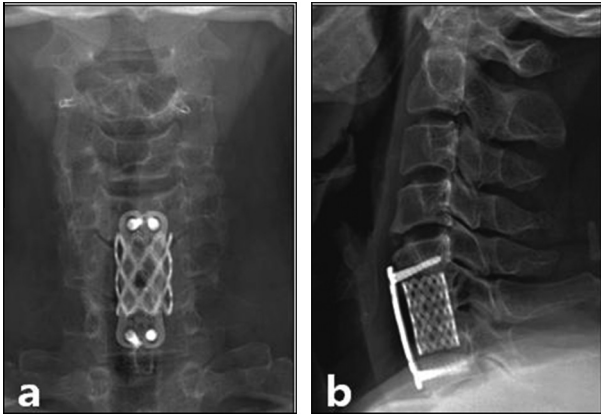
The study analyzed the records of 50 consecutive patients who underwent one-level corpectomy or one- or two-level discectomy with plate fixation by a single experienced surgeon at our Neurosurgery Department between August 2004 and December 2009. The Codman and Zephir anterior cervical plates were used for 27 patients (from August 2004 to July 2008) and 23 patients (from July 2007 to December 2009), respectively. Patients who underwent more than two level fusion or revision surgery were excluded from the study.

## 2.1. Plate profiles

Zephir plates have a low profile (Fig. 1) which to our knowledge is the thinnest in production, and are 15 mm wide and 1.6 mm

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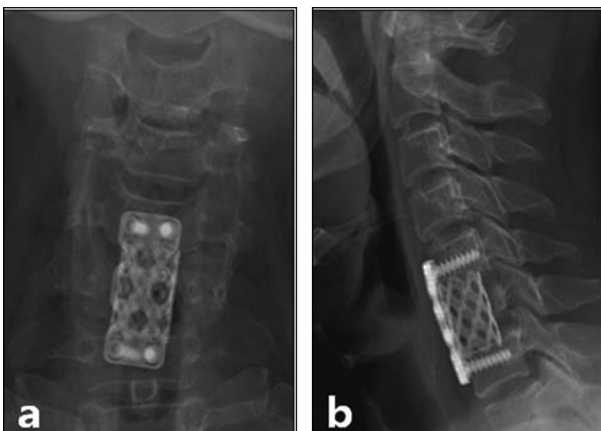


**Fig. 1.** Plain (a) anteroposterior and (b) lateral radiographs of a patient with a Zephir anterior cervical plate (Medtronic Sofamor Danek Inc., Memphis, TN, USA).

thick. Codman plates (Fig. 2) are 17.58 mm wide and 2.69 mm thick.

## 2.2. Surgical technique

Awake fiber optic nasal intubation was performed in patients with myelopathy. The patient was placed in a supine position with the head extended without side rotation or traction. The cervical spine was approached from the right side in all patients. The mid-line was identified using the orientation of the longus colli on each side. Using monopolar cautery, the muscles were mobilized laterally to expose the anterior surface of the index cervical vertebrae. Retractor blades were placed beneath the muscles to prevent the blades slipping and to prevent injury to the esophagus/carotid sheath contents. For corpectomy, a mesh cage with autologous bone obtained during the vertebrectomy was used for grafting. For anterior cervical discectomy and fusion (ACDF), autologous iliac bone was harvested and used. The longest possible screw for a cervical plate without bicortical purchase of the vertebral body was inserted. Prominent anterior osteophytes were resected. During surgery, the cervical retractor was released for 5 minutes intermittently, and endotracheal tube pressure was monitored. The endotracheal tube was routinely maintained for 3–6 hours in order to avoid postoperative respiratory problems, without perioperative steroid administration. The endotracheal tube was removed when



**Fig. 2.** Plain (a) anteroposterior and (b) lateral radiographs of a patient with a Codman anterior cervical plate (Johnson and Johnson Professional Inc., Raynham, MA, USA).

no prevertebral soft tissue swelling was confirmed radiologically after surgery.

## 2.3. Postoperative assessment

Dysphagia was classified as short-term (occurring within 6 months postoperatively) or persistent (persisting for longer than 6 months postoperatively). The patients were followed for at least 6 months after surgery and we re-evaluated for dysphagia using the Bazaz scoring system<sup>5,6</sup> via telephone interview by a single interviewer in May 2010 when data was analyzed retrospectively. The patients were graded as having no, mild, moderate, or severe dysphagia based on the telephone evaluation (Table 1). The patients who experienced no episodes of swallowing difficulty were graded as “none.” Patients who experienced only rare episodes of dysphagia were graded as “mild.” These patients did not feel that their dysphagia was a significant problem. Moderate dysphagia was defined as occasional swallowing difficulty with very specific foods (i.e., bread or noodles). “Severe” dysphagia was defined as frequent difficulty swallowing the majority of food. The follow-up telephone interview occurred 6–12 months postoperatively for 11 patients, 13–24 months postoperatively for six patients, and 25–36 months postoperatively for six patients treated with the Zephir plates. The follow-up telephone interview occurred 13–24 months postoperatively for one patient, 25–36 months postoperatively for three patients, 37–48 months postoperatively for 10 patients, and over 49 months postoperatively for 13 patients treated with the Codman plates. CT scans and flexion–extension radiographs were performed 6 months postoperatively to determine the fusion status. At that time, a radiological assessment was performed in the outpatient department, and neurological function was evaluated at the last follow-up and compared to the preoperative status using the Nurick scale.

## 2.4. Statistical analysis

Statistical analysis was performed using the Statistical Package for the Social Sciences software (SPSS Inc., Chicago, IL, USA). Fisher’s exact test was used for between-group comparison of postoperative dysphagia, and to determine any correlation between sex and dysphagia. Paired *t*-tests and Wilcoxon signed rank tests were used to determine postoperative neurologic improvement using the Nurick scale. The Mann–Whitney test was used to analyze the relationship between age and dysphagia. Data are reported as mean ± standard deviation.

## 3. Results

### 3.1. Clinical data

The 50 patients comprised 33 men and 17 women (sex ratio 1.94). The average age was 50.6 years (range 21–74 years) and the average follow-up period was 16.6 months (range 6–48 months). Zephir plates were used in 23 patients, comprising

**Table 1**  
Dysphagia score at 6 month follow-up following plate placement during anterior cervical spine surgery

Severity	Difficulty swallowing	
	Liquid	Solid
None	None	None
Mild	None	Rare
Moderate	None or rare	Occasional (only with specific foods)
Severe	None or rare	Frequent (majority of solids)

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