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Comparison of retroauricular and small transcervical approaches for endoscopic-assisted selective neck dissection: a cadaveric study

S. Lee, W. Nam
Department of Oral and Maxillofacial Surgery, Yonsei University College of Dentistry, Seoul, Republic of Korea

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Abstract. Advances in endoscopic-assisted neck surgery have allowed surgeons to conceal the scars via various approaches. However, studies comparing the approaches are still rare. The aim of this study was to comparatively analyze the feasibility and oncological outcomes of the retroauricular approach (RA) and the small transcervical approach (STC) for endoscopic-assisted selective neck dissection (EASND). Five fresh cadavers were recruited. EASND was performed via RA on one side and via STC on the contralateral side of each of the cadavers. The duration of the procedure was subdivided into preparation and EASND, and was recorded during the operation. The preserved vital structures were inspected by another surgeon after the cadaver dissection. The total number of lymph nodes retrieved was assessed by a pathologist. There was no significant difference in lymph node count between the RA group (mean 21, range 9–38) and the STC group (mean 23, range 7–34) ($P > 0.05$). The operation time was significantly longer in the RA group than in the STC group (preparation, $P = 0.042$; EASND, $P = 0.043$). In terms of surgical feasibility, STC can be chosen as the approach of choice for EASND. In spite of a long learning curve, RA might be an alternative option in particular cases to minimize scarring.

Key words: endoscopic-assisted neck dissection; selective neck dissection; head and neck cancer; retroauricular approach; minimally invasive surgery.

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In clinically node-negative (cN0) head and neck cancer patients, selective neck dissection (SND) has been established as standard care for the management of regional lymph nodes[1]. There has been controversy regarding the type of neck dissection that is most beneficial to survival: therapeutic neck dissection after surveillance or elective neck dissection

for prophylactic purposes[2–5]. Recently, a prospective, randomized controlled trial with a large cohort demonstrated higher survival for level I–III elective neck dissection than for therapeutic neck dissection after surveillance in cN0 oral cavity cancer patients[6,7]. Despite the better survival outcome, these patients potentially face further quality of life issues arising from postoperative scarring.

Visible and exposed scars occurring after head and neck surgery lead to important aesthetic, functional, and psychosocial issues[8,9]. To overcome this morbidity factor, minimally invasive approaches have been introduced. Since the first preclinical studies on endoscopic neck dissection[10,11], several reports have demonstrated the oncological safety and aesthetic superiority of minimally invasive surgery. Various approaches to the neck have also been introduced for minimally invasive surgery, including transaxillary[12], retroauricular[12,13], transoral[14], and transcervical[15–17]. Among these, it is well documented that retroauricular (or modified facelift) approaches demonstrate favourable aesthetic and functional outcomes for SND[13]. However, some authors have highlighted the detrimental invasiveness of the retroauricular approach (RA) and have suggested the small transcervical approach (STC) for SND[15,16]. Nevertheless, few studies have been done in which a comparative analysis of the two principal approaches for SND has been performed. There is, therefore, a need to clarify the characteristics of the two approaches in this context.

The aim of this cadaveric study was to assess and compare the feasibility and oncological outcomes of RA and STC for endoscopic-assisted SND (EASND), laying the groundwork for a clinical prospective comparison study of the two approaches.

Materials and methods

Five fresh adult Korean cadavers (three male and two female) aged 39–89 years at death (mean age 64 years) were used. None of the cadaveric specimens had any congenital malformation, pathological findings, surgery, or trauma in the head and neck area. This study was performed in accordance with the principles outlined in the Declaration of Helsinki. Appropriate consent and approval were obtained from the families before use of the cadavers. EASND was performed via RA on one side and via STC on the contralateral side of each of the cadavers. The endoscopic-assisted dissection was done by a skilled surgeon (W.N.) using a 30-degree, 4-mm diameter, 18-cm length endoscope (IMAGE1 S; Karl Storz, Tuttlingen, Germany) and compatible retractor (self-retaining retractor; Sejong Medical Co. Ltd, Paju, Gyeonggi-do, Korea). The surgical techniques are outlined below.

Cadaveric dissection by retroauricular approach

The surgical technique for the RA was performed as described in a previous report[18]. The cadaver was placed in the supine position with neck extension and head tilt towards the contralateral side. The incision line and anatomical landmarks for endoscopic neck dissection were outlined on the neck. A retroauricular incision was made from the tragus region, extended posteriorly, and curved along the hair line. A skin flap was elevated above the sternocleidomastoid muscle (SCM). After exposure of the SCM, a subplatysmal dissection was performed, proceeding inferiorly and anteriorly towards the omohyoid muscle, hyoid bone, and the midline of the neck. After flap elevation using an Army-Navy retractor or right-angled breast retractor, a self-retaining retractor (Sejong Medical Co. Ltd) was installed to maintain the working space (Fig. 1A). If necessary, an additional pre-auricular incision can be made to expand the working space; this is referred to as the modified face lift approach.

After identification of the marginal mandibular branch of the facial nerve, the facial vein was ligated with vascular clips and divided. The SCM and digastric muscle were retracted posteriorly by an assistant surgeon and a lymphadenectomy was initiated from level IIb, under direct view, using an ultrasonic scalpel, electrocautery, and curved sharp Metzenbaum scissors. The carotid sheath was also dissected along level IIa and III. The endoscope was then applied in the level I area after fixation with an endoscope holder (Karl Storz, Tuttlingen, Germany). Careful dissection of level Ia was performed, proceeding along the midsagittal line of the neck. After the mylohyoid muscle was identified and the lingual artery and hypoglossal nerve were secured, the submandibular ganglion and Wharton's duct were sealed with the ultrasonic scalpel. After

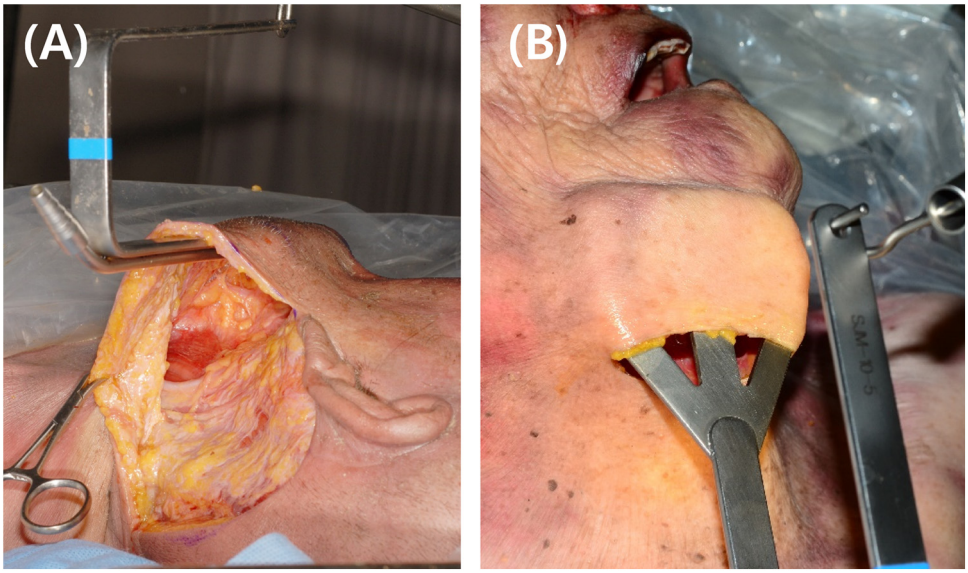

Fig. 1. Establishment of the working space for endoscopic-assisted neck dissection. (A) A self-retaining retractor set-up for level Ib and Ia dissection via retroauricular approach. (B) A self-retaining retractor set-up for level Ia dissection via small transcervical approach.

dissection of level Ib, the inferior margin of the surgical specimen was separated at the level of the omohyoid muscle. After the surgical specimen had been removed with blunt-end long forceps or endoscopic alligator forceps, the endoscope was pulled out.

Cadaveric dissection by small transcervical approach

A small transcervical incision about 4 cm in length was made along the skin fold in the upper lateral neck. The subplatysmal skin flap was elevated anteriorly to the midline of the neck, superiorly to the lower border of the mandible, and inferiorly to the level of the omohyoid muscle. The dissection was performed primarily at level II under retraction using an Army-Navy retractor or right-angled breast retractor. After dividing the external jugular vein at the anterior border of the SCM muscle, the overlying fascia was elevated until the internal jugular vein was exposed medially and the parotid gland superiorly. If the SCM muscle and digastric muscle were retracted adequately, the level IIa and IIb lymph nodes could be dissected under direct vision. After identification of the spinal accessory nerve, the internal jugular vein was exposed and the carotid sheath was dissected along level IIa and III. If necessary, endoscopic-assisted dissection was performed for the superior margin of level IIb and inferior margin of level III. The endoscope was held by the assistant surgeon. After the marginal mandibular branch of the facial nerve had been identified and the distal facial vein ligated, a level Ib dissection was performed in the same way as in conventional open surgery. A self-retaining retractor was then installed and endoscopic-assisted dissection of level Ia was performed, proceeding in the manner mentioned above for the RA (Fig. 1B)[17]. After complete separation of the surgical specimen, it was pulled out with blunt-end long forceps or endoscopic alligator forceps.

Table 1. Lymph node count obtained from endoscopic-assisted selective neck dissection using the two approaches.

Cadaver	Retroauricular approach	Small transcervical approach
1	38	32
2	14	19
3	9	7
4	20	23
5	24	34
P-value	1.00	

Inspection and analysis of cadaveric dissection

After removal of the specimen, the surgical field was exposed with an extensive visor flap and comprehensively inspected by another surgeon (S.L.) to verify proper resection of the lympho-adipose tissues and preservation of the anatomical structures. The surgical specimen was fixed in 10% neutral buffered formalin and submitted to the pathology department for nodal examination. Lymph nodes were identified macroscopically by palpation and dissected. Only lymphoid tissue with a microscopically distinct fibrous capsule was considered in the lymph node count (LNC). The LNC was defined as the total number of lymph nodes retrieved.

During neck dissection, the durations (time elapsed) of the preparation stage and the EASND were recorded. The preparation time was defined as the time taken from skin incision to installation of the retractor, including the establishment of the working space. The EASND time was defined as the time taken from neck dissection under direct view and endoscopic view to removal of the final specimen.

Numerical data were obtained and the Wilcoxon rank sum test was used to assess the significance of differences in each cadaver. All analyses were performed using IBM SPSS Statistics for Windows, version 22.0 (IBM Corp., Armonk, NY, USA). A probability value (two-tailed) of less than 0.05 was considered to indicate statistical significance ($P < 0.05$).

Results

The mean number of lymph nodes in the RA group was 21 (range 9–38) and in the STC group was 23 (range 7–34). There was no significant difference in LNC between the two approaches ($P > 0.05$) (Table 1).

However, the mean preparation time and mean EASND time differed significantly between the two approaches. The mean preparation time was 32.6 min (range 22–46 min) in the RA group and 16 min (range 10–24 min) in the STC group ($P = 0.042$) (Fig. 2). The mean EASND operation time was 102.6 min (range 78–135 min) in the RA group

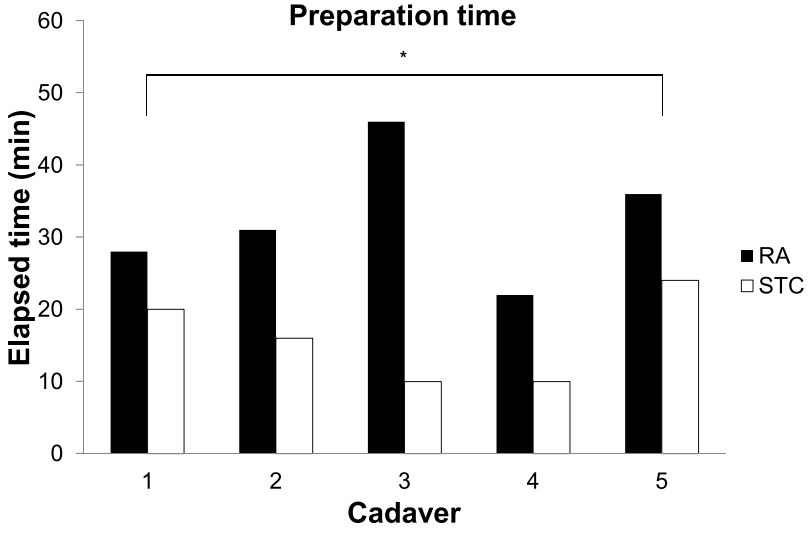

Fig. 2. Preparation time. The preparation time was significantly longer in the retroauricular approach group (RA) than in the small transcervical approach group (STC) ($P = 0.042$).

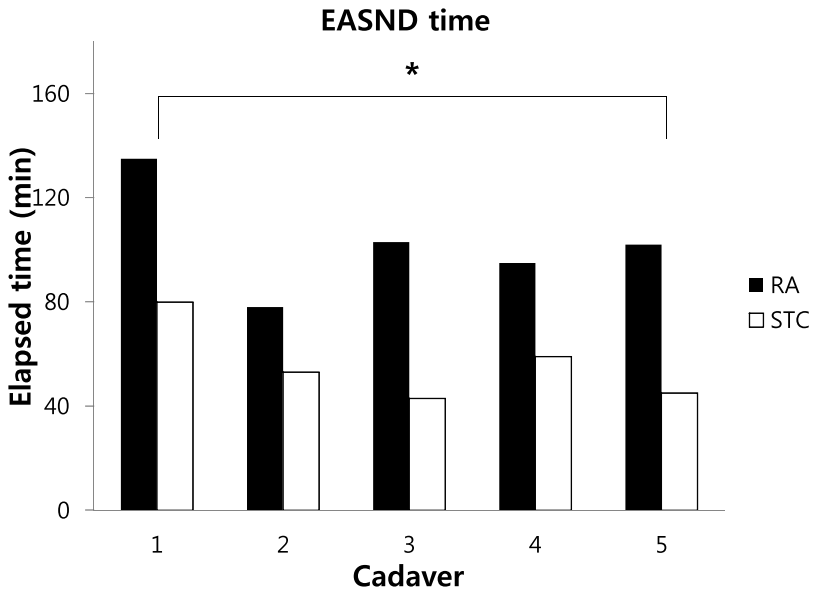

Fig. 3. Endoscopic-assisted selective neck dissection time. The time elapsed was significantly longer in the retroauricular approach group (RA) than in the small transcervical approach group (STC) ($P = 0.043$).

Table 2. Characteristics of the two approaches for endoscopic-assisted selective neck dissection.

Characteristics	Retroauricular approach	Small transcervical approach
Cosmetic results	No visible scar on neck	Small scar on neck
Operation time	Prolonged	Shorter
Neck levels accessible with direct approach	II, III	Ib, II, III
Neck levels requiring endoscopic approach	Ia, Ib	Ia, II, III
Accessibility for micro-anastomosis	Unfavourable	Favourable
Access for mandibulectomy	Intraoral	Extraoral
Conversion to conventional open surgery	Not available	Available

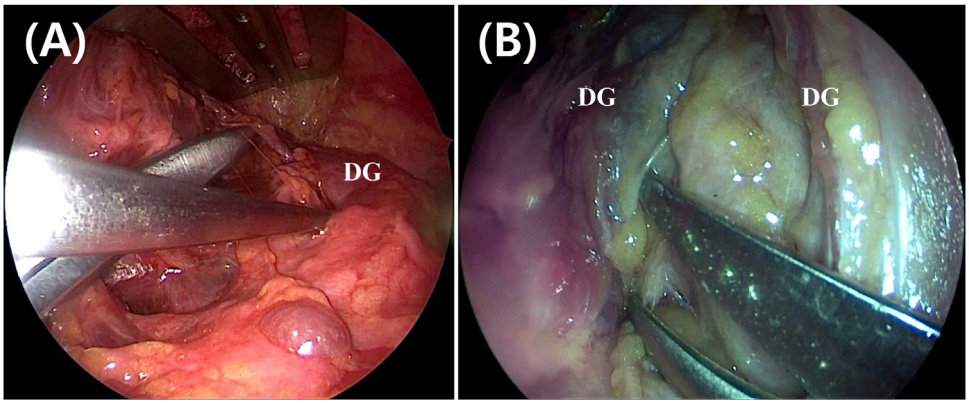

Fig. 4. Endoscopic surgical view of level Ia dissection. (A) The retroauricular approach exhibits a limited surgical field and narrow, long working space. (B) The small transcervical approach provides a sufficient surgical field for endoscopic-assisted dissection. DG, digastric muscle.

and 56 min (range 43–80 min) in the STC group ($P = 0.043$) (Fig. 3).

Except for cadaver No. 1, in which the lingual nerve was cut off during RA, the vital structures including the marginal branch of the facial nerve, spinal accessory nerve, internal jugular vein, carotid artery, vagus nerve, phrenic nerve, superior thyroid artery, lingual nerve, and hypoglossal nerve were successfully identified and their structural integrity was adequately preserved.

Discussion

Among the various minimally invasive approaches to the neck, the RA can conceal the wounds beneath the hair and auricle, making it especially beneficial for young female patients diagnosed with early stage head and neck cancer who are clinically negative for cervical metastasis. Of note, compared with the Caucasian population, the frequency of hypertrophic scarring has been reported to be threefold in the Asian population[19]. The demand to hide scarring is, therefore, increasing in

this population. Korean groups have demonstrated that minimally invasive head and neck surgery via RA provides outcomes corresponding to the conventional open surgery in functional and cosmetic aspects[20,21]. However, some authors pointed out the shortcomings of the technique, such as limited range of motion, longer operation time, and larger amount of dissection in the retroauricular area[15,16]. As a result, a transcervical approach via small lateral neck incision with a reduced range of dissection and more rapid procedures was introduced. In addition, it has been reported that conversion to a conventional open neck dissection is possible with the STC. This cadaveric study focused on assessing two principal approaches with an identical objective, with regard to technical feasibility and oncological safety for clinical implementation.

It is generally accepted that removing more lymph nodes contributes to the eradication of micro-metastases and a more accurate pathological diagnosis, which subsequently affects decisions regarding adjuvant therapy[22]. The LNC was applied to examine the oncological outcomes of EASND via the two different approaches in this study. The mean LNC from the cadavers exceeded the cut-off range of 16–18 nodes reported in previous investigations[23,24]. Although the node count for cadaver No. 3 was not sufficient for oncological safety, considering that similar numbers of lymph nodes were retrieved from the bilateral neck, this might be attributed to inherent characteristics of this patient. For each individual cadaver, there was no significant difference in LNC between the two approaches. This indicates that both RA and STC may be acceptable procedures and implemented clinically in EASND. Further prospective comparative studies between RA and STC should be performed, with a large cohort, in consideration of perioperative parameters and long-term survival data.

The characteristics of the two approaches are shown in Table 2. The durations of both the preparation stage and EASND were significantly longer in the RA group than in the STC group. Also, it was difficult to obtain an endoscopic view sufficient to dissect levels Ib and Ia with the RA: in cadaver No. 1, which was obese, the lingual nerve was damaged during endoscopic dissection on the RA side. For level Ia dissection in particular, the RA exhibits a limited surgical view and narrow working space when compared with the STC (Fig. 4A, B). Although the number of cadavers investigated was small, the study results indicate that the STC has more benefits regarding oncological efficiency and feasibility, being standard techniques for EASND. In the clinical situation, obesity plus a short neck might be included as a relative contraindication for RA, while the STC should be adopted for EASND. In addition, the immediate conversion of the STC to conventional open surgery is possible. Thus, STC may also be employed for EASND in patients for whom the need for open neck surgery is highly probable or patients for whom reconstruction with a microvascular free flap is required[17].

The cadaveric neck dissections in this study were performed by a single surgeon with extensive skills in endoscopic surgery, including open reduction and internal fixation of condylar fractures, neck dissection, and harvesting of radial forearm free flaps. There were thus no specific difficulties in the endoscopic visualization and manipulation of the surgical instruments. For young surgeons, the long learning curve of EASND might be much more troublesome in RA cases than in STC cases.

Despite the difficulties of the RA as mentioned above, several surgeons have taken into consideration a particular culture in which exposure of neck scarring is an intolerable condition for young women and, therefore, the need for an approach to ameliorate this. In the setting of the clinically node-negative neck, they have developed the RA for EASND and have demonstrated favourable oncological outcomes for RA, comparable to those of conventional neck dissection. Hiding the scar in the hairline provides the patients with satisfactory cosmesis. In this context, we cautiously propose the RA for EASND as an alternative approach in patients with early-stage head and neck cancer demanding a highly aesthetic outcome. Although surgeons should prioritize oncological effectiveness and preservation of the vital structures over aesthetic considerations, limited application might be necessary for such patients.

This study is novel with regard to the comparative analysis of the RA and the STC for EASND. Regarding nodal clearance, a similar LNC was observed with the two approaches. However, due to its effectiveness and accessibility, the STC might be utilized as the approach of choice for EASND. The RA could be an option for early-stage cancer patients who are eager to hide the cervical cicatrix.

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Competing interests. None declared.

Ethical approval. As a cadaveric experiment, this study did not require ethical approval.

Patient consent. Not required.

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Address:
Woong Nam
Department of Oral and Maxillofacial Surgery
Yonsei University College of Dentistry
50-1
Yonsei-ro
Seodaemoon-gu
Seoul 03722
Republic of Korea
Tel.: +82 2 2228 2971
Fax: +82 2 2227 8022
E-mail: omsnam@yuhs.ac