



Free Flap Elevation Times in Head and Neck Reconstruction Using the Harmonic Scalpel Shears

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Summary: Free tissue transfer has become the mainstay of head and neck cancer (HNC) reconstructive surgery. The objective of the study is to examine the efficacy of the Harmonic Scalpel (HS) Shears on free flap elevation time and complication rates after HNC reconstruction compared with traditional electrocautery. A retrospective review of 215 HNC patients undergoing surgical ablation and free flap reconstruction from January 2010 to April 2013 at the University of Alberta Hospital was undertaken. All patients requiring free flap reconstruction with radial forearm free flap or fibula free flap were included. Overall, there was no significant difference demonstrated between the HS and electrocautery groups for free flap elevation time for RFFFs ($P = 0.563$) or FFFs ($P = 0.087$). No differences were observed in donor-site complications. The HS is a reliable, safe, and alternative method of free flap elevation in HNC reconstructive surgery. (*Plast Reconstr Surg Glob Open* 2016;4:e718; doi: 10.1097/GOX.0000000000000740; Published online 25 May 2016.)

Free tissue transfer has become a common option for reconstruction of defects after oncologic head and neck ablative surgery. The radial forearm free flap (RFFF) and the fibula free flap (FFF) are frequently utilized for reconstruction in head and neck cancer ablation because of their relatively reliable anatomy and pedicle length. Harvesting of both the RFFF and FFF involves dissection of numerous perforating vessels and a significant amount of soft tissue. Traditional methods of free

flap elevation include a combination of electrocautery (EC) with clipping and tying of vessels or use of traditional bipolar EC. However, these methods can be time consuming and labor intensive. Given the current culture of operative efficiency and limited resources in the provision of healthcare, both safety and efficiency in operative techniques and equipment are a priority.

The Harmonic Scalpel (HS) shears (HS; Ethicon Endo-Surgery, Cincinnati, Ohio) represent an alternative to traditional techniques of free flap elevation. The HS vibrates at 55,000 Hz, converting high-frequency ultrasonic energy into mechanical energy. The vibration disrupts hydrogen bonds in human tissue, forming a coagulum. Proposed advantages of the HS compared with conventional cautery include lower temperatures resulting in decreased adjacent tissue damage (80–100°C for HS as compared with 200–300°C for traditional EC) and increased efficiency by allowing concurrent surgical dissection and hemostasis of small-to-medium-sized vessels with a single instrument. The use of ultrasonic dissection was first utilized in gastrointestinal surgery,^{1–3} before

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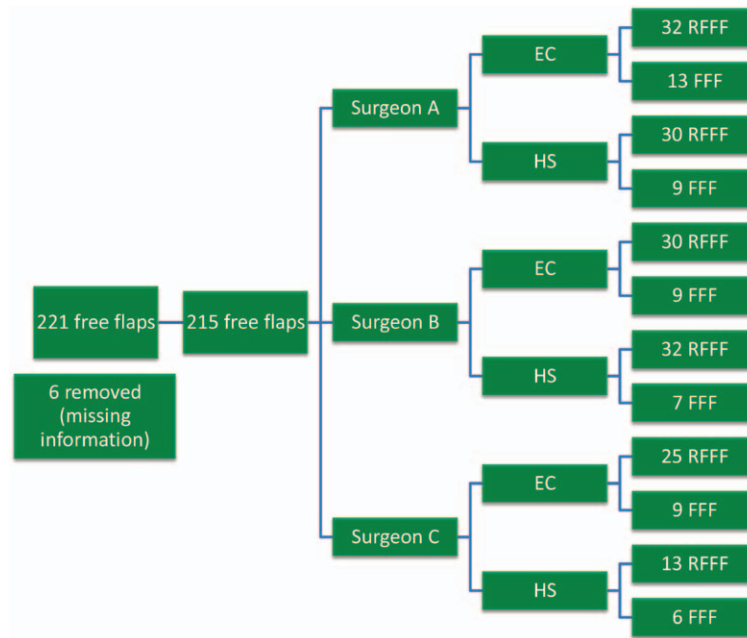


Fig. 1. Summary diagram depicting the use of the HS compared with electrocautery and the number of each type of free flap performed by 3 surgeons between 2010 and 2013.

expanding to a variety of other surgical fields. In the head and neck region, this has included both thyroid surgery,^{4,5} and head and neck reconstruction.⁶⁻⁹ The HS has been shown to be a safe alternative in head and neck reconstruction.^{7,9} Previous studies have also shown reduced operative time with HS.^{6,8}

The primary objective of this study was to assess the efficacy of HS in reducing free flap elevation times in RFFFs and FFFs. A secondary outcome evaluated was a comparison of donor-site morbidity between the 2 methods.

MATERIALS AND METHODS

A retrospective review of all head and neck cancer (HNC) patients undergoing surgical ablation and free flap reconstruction from January 2010 to April 2013 was undertaken. Approval was obtained by the Health Research Ethics Board (Pro00025159). All patients requiring free flap reconstruction with RFFF or FFF, performed by 1 of 3 head and neck surgeons at the University of Alberta Hospital, were included. Patients excluded were those for whom primary or secondary outcome data were unavailable.

The primary outcome assessed was free flap elevation time. Tourniquet time, the time between initial inflation of the tourniquet and deflation time in minutes, was used as a surrogate marker for free flap elevation time. The secondary outcome was donor-site morbidity, which included development of a seroma, hematoma, or infection. Free flap eleva-

tion time for each flap with the HS was compared with free flap elevation time using EC for both RFFFs and FFFs. Surgical technique utilized (HC or EC) was based on surgeon preference on the day of surgery. Analyses were performed separately for each surgeon and each technique, to account for differences in operative abilities and preferences. Statistical analysis was performed using the Mann-Whitney U test, and $P = 0.05$ was set as the threshold for statistical significance.

RESULTS

A total of 221 patients underwent reconstruction for ablative head and neck cancer surgery using RFFFs or FFFs at the University of Alberta between January 2010 and April 2013 (Fig. 1). Six patients were excluded because of missing information or

Table 1. Demographic Data for Patients Undergoing RFFF or FFG Reconstruction for Major Head and Neck Cancer Surgery from 2010 to 2013 at the University of Alberta Hospital

Number of patients included	215	
HS	97	
EC	118	
Male/female ratio		
HS	68/32	$P = 0.415$
EC	63/37	
Average age (y)		
HS	58.0	$P = 0.490$
EC	59.9	

Table 2. Average Time for RFFF and FFF Elevation Using the HS Compared with Traditional EC for 3 Surgeons at the University of Alberta Hospital from 2010 to 2013

Primary Outcome	Free Flap	EC Time (min)	HS Time (min)	Difference (min)/ % Change	<i>P</i>
Surgeon A	RFFF	65.9	66.7	0.8/1.2	0.617
	FFF	69.1	67.4	-1.7/-2.5	0.947
Surgeon B	RFFF	57.0	64.3	7.3/12.8	0.029
	FFF	84.7	83.7	-1/-1.2	0.916
Surgeon C	RFFF	74.4	68.2	-6.2/-8.3	0.325
	FFF	78.1	63.2	-14.9/-19.1	0.087

Table 3. Secondary Outcome—Donor Site Complications for Free Flaps Performed with the HS Compared with Traditional EC

Donor-Site Complications	EC	HS	<i>P</i>
Seroma	3	8	0.059
Hematoma	2	0	0.202
Wound infection	2	1	0.440

lack of tourniquet use, and therefore the data collected for 215 patients were used in the analysis (Fig. 1). Patients' age ranged from 15 to 87 years (mean = 58.0 years) in the HS group compared to 18 to 86 years (mean = 59.9 years) in the EC group ($P = 0.490$). Overall, 118 of these free flaps were elevated using traditional methods, compared with 97 performed with the HS (Table 1). For RFFF elevation, the HS group showed average time differences between -8.3% and +12.8% when compared with the EC group. This corresponded to time differences between -6.2 and +7.3 minutes (Table 2). When examining FFF elevation times, the HS group showed average time decreases between 1.2% and 19.1%. This corresponded to time decreases between 1.0 minute and 14.9 minutes (Table 2). When evaluating the use of the HS group compared with the EC group for each surgeon, a statistically significant increase in time was found for 1 surgeon when elevating RFFFs ($P = 0.029$; Table 2). Besides, no statistically significant difference in free flap elevation time was demonstrated when using the HS (Table 2). With regard to donor-site morbidity, no significant difference in complications between the 2 methods was demonstrated (Table 3).

DISCUSSION

This study demonstrated that using the HS Shears for elevation of RFFFs and FFFs during reconstruction for oncologic ablative head and neck surgery is both safe and reliable, but failed to demonstrate a significant difference in elevation time when compared with traditional EC. However, it should be noted that there was a trend toward increased donor-site seromas in the HS group. Although it did not reach statistical

significance ($P = 0.059$), it did approach it. It could, therefore, be inferred that use of the HS may lead to increased donor-site seromas when compared with EC.

Medicine, and especially surgery, has become increasingly focused on resource conscious and efficient means of delivering patient care. Previous studies have evaluated the economic implications of using the HS for free flap elevation and have demonstrated a cost benefit.^{6,8} However, as this was a retrospective study, the cost of all materials was not readily available. In addition, as no significant decrease in free flap elevation time was demonstrated when using the HS, an economic benefit would likely not have been observed.

Furthermore, given the retrospective nature of the study, additional factors such as the size of the flap and the patient-specific factors such as body mass index (BMI) were not taken into consideration. These factors may have an impact on free flap elevation time and should be evaluated in a prospective fashion to further delineate the use of this tool in specific types of patients and selected free flap options. For example, with the extensive soft tissue dissection required in anterolateral thigh free flaps or scapular free flaps, a time decrease may be more readily observed.

CONCLUSIONS

Overall, use of the HS Shears for free flap elevation resulted in a lack of significant difference in free flap elevation time for radial forearm ($P = 0.563$) or fibula ($P = 0.087$) free flaps. In addition, no significant differences were observed in free flap donor-site morbidity between the HS and EC groups. On the basis of these results, we can conclude that the HS is a reliable, safe, and alternative method of free flap elevation in head and neck cancer reconstructive surgery.

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