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Neck dissection with the harmonic scalpel in patients with squamous cell carcinoma of the oral cavity

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ABSTRACT

Our purpose was to evaluate the use of the Harmonic scalpel in neck dissections.
Material and methods: We conducted a randomized prospective intervention study to compare the Harmonic scalpel (32 patients) with the conventional technique (31 patients).
Results: Operative time was lowered by 64 min ($p < 0.001$) and 7.5 min ($p = 0.367$); blood lost during surgery was lowered by 80.5 ml ($p < 0.001$) and 76.6 ml ($p < 0.001$); the length of time the drains were kept in place was lowered by 1.3 days ($p < 0.001$) and 1.5 days ($p < 0.01$); and the volume of drainage was lower by 228.7 ml ($p < 0.001$) and 187.6 ml ($p < 0.01$) in selective and comprehensive neck dissections respectively in patients treated with the Harmonic scalpel.
Conclusions: The Harmonic scalpel shortens operative time in selective dissections. It reduces blood loss during surgery; time drains are kept in place and the amount of drainage in comprehensive and selective neck dissections.

1. Introduction

Squamous cell carcinoma of the oral cavity often starts with a primary lesion and can then spread to the lymph nodes of the neck. Surgical treatment of these tumours includes local resection and neck dissection (Martínez-Gimeno et al., 2011). Neck dissection has played an important role in the management of squamous cell carcinoma of the oral cavity (Pagedar and Gilbert, 2009). Modifications to the classical procedure have been devised which results in less postoperative morbidity (Zhang et al., 2011). The selective procedures were developed in order to control regional metastasis while reducing the morbidity of radical neck dissection. The basis for description of selective neck dissection procedures is the classification system of lymph node levels (Pagedar and Gilbert, 2009; Thiele et al., 2012).

Controlled haemostasis is essential in surgery for neck dissection. The Harmonic scalpel (Harmonic®, Ethicon Endo-Surgery, Germany) is a device that uses ultrasonic energy to cut and produce coagulation of soft tissues. Its mechanism of action is based on the conversion of electrical energy into mechanical energy (ultrasonic vibration). The handset vibrates at a high frequency (55,000 cycles/s) with a maximum longitudinal displacement of 100 microns (Haegner et al., 2002) (Fig. 1).

The Harmonic scalpel has four effects on the tissues: coaptation, coagulation, cutting and cavitation. The active blade vibration causes defragging of the proteins by breaking the hydrogen bonds; these proteins are transformed into a "glue" that seals the smaller vessels. The secondary heat produced by friction causes protein denaturation. With the Harmonic scalpel there is little lateral spread of coagulation, but it increases when the vibration is activated over 4–5 s. The vibration of the active terminal produces very rapid changes of pressure in the tissues causing vaporization of intra- and intercellular water at a low temperature; this causes separation of the anatomical planes, thus facilitating visualization and surgical dissection at temperatures between 60 °C and 80 °C (Eman and Cuschieri, 2003; Blankenship et al., 2004). Unlike the Harmonic scalpel, the laser scalpel and electrocautery induce coagulation by burning (obliterative coagulation) at high temperatures (150 °C–400 °C). The heat produced is directly proportional to the power level and length of time. We can control the effects of the Harmonic scalpel on the tissues by varying the energy level, tissue tension, pressure applied when closing the scissors and type of terminal. With higher energy, faster cutting is achieved with less haemostasis is achieved. With a lower power level, haemostasis is more intense, but the cutting is slower. The higher the tension on the tissues, the quicker the speed when cutting.

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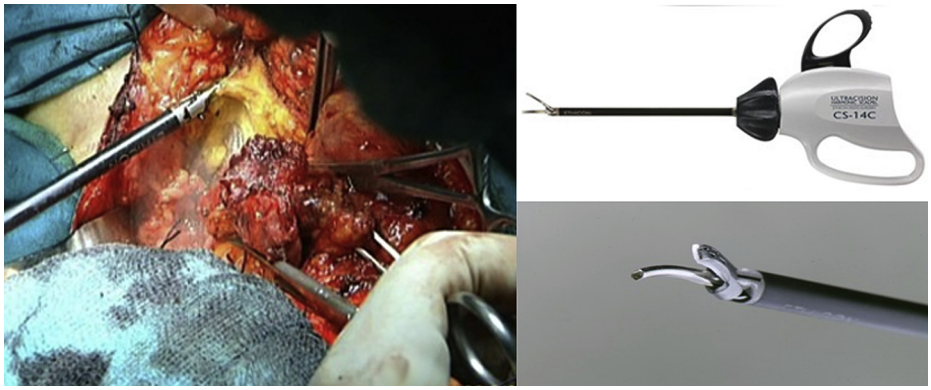

Fig. 1. Neck dissection with the Harmonic scalpel, and the handset.

The use of the Harmonic scalpel in maxillofacial surgery is relatively new. The main advantage of the Harmonic scalpel in Maxillofacial Surgery is that the surgical field remains bloodless, thus facilitating surgery and reducing operative time by avoiding ligatures or electric coagulation for haemostasis. It is being used to perform tonsillectomy, thyroidectomy, glossectomy, superficial parotidectomy, submandibular gland resection, surgical treatment of rhinophyma, rhytidectomy, resection of oral cavity tumours, elevation of pectoralis major myocutaneous flap (Deo et al., 2005), latissimus dorsi flap (Inaba et al., 2000), radial forearm free flap, serratus free flap and fibula free flap and endoscopic resection of the submandibular gland. Few references in the literature (Kos and Engelke, 2007; Salami et al., 2008a,b; Miccoli et al., 2009; Walen et al., 2011) can be found where the use of the Harmonic scalpel to perform neck dissections, both classic and modified, comprehensive or selective, is evaluated. The purpose of this study was to evaluate the use of the Harmonic scalpel in neck dissections in patients with squamous cell carcinoma of the oral cavity in comparison with the conventional surgical technique.

2. Material and methods

This is a prospective, randomized, trial of the use of the Harmonic scalpel in neck dissection in patients with squamous cell carcinoma of the oral cavity, without any treatment before surgery, compared with a control group in which the conventional surgical technique was used. Patients were treated from July 2004 to September 2008. The main variables measured were: the operative time in minutes, the volume of blood lost during surgery in millilitres, the time the drains were kept in place in the postoperative period (in full days), the total drainage volume during the first three postoperative days in millilitres. Other data collected were, patient' age, gender and the type of neck dissection (comprehensive or selective). The decision concerning which type of dissection was performed, was based on clinical staging. A comprehensive neck dissection is one that removes all lymph node groups (I–V) that would be included in a classic radical neck dissection. Selective neck dissections have been developed based on an understanding of the common pathways by which head and neck cancers spread to regional nodes, removing the nodes most commonly involved with metastases from the oral cavity. A selective neck dissection is recommended which includes the nodes found above the omohyoid muscle (levels I–III and sometimes level IV and IIb). In the group treated with the Harmonic scalpel, the ease of use (easy, medium or hard) and the occurrence of intraoperative complications related to the use of Harmonic scalpel were also evaluated. Two expert oral and maxillofacial surgeons, with similar surgical experience, performed all the dissections. Neck dissections made by other maxillofacial surgeons of the Department were not included in this study. We considered as clinically relevant a difference in surgery time of 30 min, a difference in blood loss of 50 ml and a difference of 1 day in drainage time. To calculate the sample size, the outcome variable with which a larger sample size was obtained was chosen; this was the variable "surgical time". Accepting an alpha risk of 0.05 and a beta risk of 0.2 in bilateral contrast, 19 subjects are needed in the first group and 19 in the second to detect a difference equal to or greater than 30 units. It was assumed that the common population standard deviation was 33. We estimated a follow-up loss rate of follow-up of 0.

The two surgical techniques used (comprehensive or selective neck dissection) have intrinsic differences in the length in surgical time, and one of the result variables is the surgical time where the aim is to assess whether there are differences in time when using the Harmonic scalpel or conventional techniques. The comparison of the mean values of the quantitative variables was performed using the Mann–Whitney *U* test. The chi-square test and Fisher's exact test were used to compare the percentage of women in each group. All the statistical tests were considered significant at $p < 0.05$, and the hypothesis tests were two-sided and the contrast hypothesis tests were bilateral. The statistical package PASW Statistics 18 (formerly SPSS Statistics) was used.

3. Results

The total number of cases studied was 63. Thirty-two (50.8%) patients underwent neck dissection with the conventional surgical technique and 31 (49.2%) patients with the Harmonic scalpel.

Forty-seven patients (74.6%) were male and 16 (25.4%) female. Comparing the type of dissection, 15 (23.8%) were comprehensive and 48 (76.2%) selective. The average age of the patients was 66 years (range 44–84). The average time of surgery was 116 min (range 70–170). The average blood loss was 66 ml (range 10–150). The mean time keeping the drains in place was 4.5 days (range 3–7).

The average total volume of drainage in the first 3 days was 354 ml (range 125–750).

In comprehensive neck dissections, the mean age of patients treated with the conventional technique was 71.43 ± 7.7, and for the Harmonic scalpel group, 65.38 ± 8.0; in selective neck dissection the mean age of patients treated with the conventional technique was 65.04 ± 8.6 and in the Harmonic scalpel group 66.74 ± 6.8. There were no statistically significant differences between the groups. In the comprehensive neck dissection group, females made up 14.3% of the total patients treated with the