



Spinal Accessory Dysfunction Following Neck Dissection with Harmonic Scalpel V/S Electrocautery – A Single Centre Experience

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Authors' contributions

This work was carried out in collaboration among all authors. Author MCK wrote the protocol and performed the statistical analysis. Author Sucheta wrote the manuscript and managed the analyses of the study. Author CM designed the study. Author RP managed the literature searches. All authors read and approved the final manuscript.

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ABSTRACT

Aims: This study is an effort towards comparing the efficacy of the Harmonic Focus and Electrosurgical technique with regard to nerve injury especially spinal accessory nerve and its morbidity postoperatively after neck dissection.

Sample: Ninety patients of oral carcinoma who required neck dissection were included in the study.

Study Design: This is a prospective study.

Place and Duration of Study: Bhagwan Mahaveer Cancer Hospital & Research Centre, Jaipur, Rajasthan, India for a period of 17 months from November 2016 to March 2018.

Methodology: Patients' post-operative recovery was studied prospectively by using parameters pertaining to shoulder function and shoulder pain.

Results: There were significant differences in the pain and abduction deformity at various time

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periods after surgery. However differences in the quality of life did not show significant difference at the end of 3 months. For up to one month pain scores were lower for Harmonic Focus and shoulder function was better through 3 months.

Conclusion: Though the technique of neck dissection (harmonic v/s electro cautery) has significant impact on shoulder dysfunction, despite that in postoperative period shoulder function measured by way of shoulder pain and shoulder abduction recover almost fully during follow-up period without causing significant morbidity and with minimal effect on quality of life. There are few recommendations we would like to suggest that if incorporated, they might significantly affect the outcome and better results.

Keywords: Spinal accessory dysfunction; neck dissection; harmonic scalpel; electrocautery.

1. INTRODUCTION

With time several instruments made their impact on surgery like monopolar cautery, bipolar cautery, radiofrequency ablator, hemo clips etc with aim to reduce the blood loss and intra operative time during head neck surgery [1]. Harmonic scalpel (HS) using ultrasonic energy became popular in head and neck surgeries since its introduction in 1990 [2,3]. Harmonic scalpel does reduce the blood loss and intra operative time for neck dissection. However there is very limited data comparing the harmonic scalpel with other conventional electrosurgical techniques with regard to nerve injury especially spinal accessory nerve (SAN) and its morbidity postoperatively after neck dissection. In this hospital based comparative study, we compared the efficacy of the HS and electrosurgical technique, with regard to SAN injury after selective neck dissection for oral cavity cancer. We assessed the shoulder function and shoulder pain immediately following neck dissection and in the subsequent follow up visits.

2. MATERIALS AND METHODS

This study was an interventional prospective study. Ninety patients of oral carcinoma who required neck dissection between November 2016 and March 2018 were included for the study. Inclusion criteria were: age 18 years with informed written consent and selective neck dissection (1 to 4) as part of treatment plan. Patients who had received prior radiotherapy, undergone prior surgery, did not give informed consent, had restriction of shoulder movements and Karnofsky Performance Score (KPS) <90 were excluded from the study. The patients are randomly and equally divided into control and experimental groups. Forty five cases were performed with harmonic focus, manufactured by Ethicon, Inc. Cincinnati OH USA and other 45 cases were done using electrocautery (EC). Both

HS and EC were set for a contact time of 1 to 4 sec. Before surgery all the patients were clinically examined, biopsy was done for primary lesion and CT scan was done to assess the nodal status and as well as disease extent. In all the neck dissection a transverse cervical incision was given and the skin flaps in both the groups were raised using mono polar electro cautery. 16FR suction drains were placed after neck dissection. Patients were given NSAIDs for first 48 hours, there after pain management drugs were given only if symptomatic.

Pain was measured by visual analogue scale (continuous scale usually 10 cm in length, anchored by 2 verbal descriptors, 0 for normal and 5 for moderate pain and 10 for extreme pain) was assessed at day 1, day 2, day 7 and 1st month and 3rd month. The spinal accessory nerve function and shoulder pain was evaluated at day 1, 1st week, 1st month and 3rd month to assess for recovery of shoulder function in both groups. Shoulder movements were assessed by means of degree of abduction and graded as grade I/0–90; grade II/90–135; grade III/135–180 degree. Quality of life was measured by using simple questionnaire (can perform routine self care activity only, can perform household chores, can do strenuous weight bearing e.g. lifting a sac of 10 kg on shoulder).

Data was entered in excel sheet to prepare a master chart & was subjected for statistical analysis. Continuous variables were summarized as mean and SD and were analyzed by using unpaired and paired t-test. Nominal/categorical variables were summarized as proportions (%) and was analysed by using chi square test/fisher exact test. Ordinal variables e.g. VAS score were summarized as median and range & were analyzed by using Mann Whitney U Test and Wilcoxon Sign Rank Test. P value of <0.05 was taken as significant. Med calc 16.4 version was used for all calculations.



Fig. 1. Harmonic focus hand piece



Fig. 2. Harmonic cord



Fig. 3. Harmonic generator

3. RESULTS

The age distribution was comparable in both the arms. (P = 0.955) Most common age group was of 51-60 yrs, with share of 33.33% and 35.56% in

control and study group respectively. The distribution of sex ratio was comparable in both the arms. (P=0.812) Male sex was most commonly affected in both the arms: 32 (71.11%) in control arm and 34 (75.56%) in study arm.

The performance status of participating patients was similar in both arms. Karnofsky performance status was used to assess the patients. Squamous cell carcinoma was the only histology in both the arms. T stage was again comparable in both the arms (P=0.499). The distribution was as followed:

- T1 disease - 13(28.89%) in control group and 7 (15.56%) in study group.
- T2 disease - 17(37.78%) in control group and 16 (35.56%) in study group.
- T3 disease - 11(24.44%) in control group and 16 (5.56%) in study group.
- T4a disease - 4 (8.89%) in control group and 6 (13.33%) in study group.

The N status was comparable for N1, N2 disease except N0 (P=0.003), as follows:

- N0 disease - 18(40%) in control arm and only4(8.89%) in study arm.

- N1 disease - 20(44.44%) in control arm and 29(64.44%) in study arm.
- N2 disease - 7(15.56%) in control arm and 12(26.67%) in study arm.
- No N 3 lesion was there in both the arms.

The subsite distribution was similar in both the arms. (P=0.418) tongue and gingivobuccal (GB) sulcus being the most common. In control group tongue 17 (37.78%) followed by GB sulcus 15(33.33%) being most common. Among study arm GB sulcus 20(44.44%) followed by tongue 14(31.11%) was the most common. Utility incision was the only incision used in both the groups.

Though the numbers of patients in harmonic group were more who needed analgesia beyond 48 hours but it was not statistically significant.

There was no difference in quality of life post- 3 month in both the arms. (P=0.70).

Table 1. Distribution of NSAID given for patients in both the arms beyond 48 hours

Oral NSAID	Control group		Study group		Total	
	No.	%	No.	%	No.	%
No	26	57.78	21	46.67	47	52.22
Yes	19	42.22	24	53.33	43	47.78
Total	45	100.00	45	100.00	90	100.00

Fisher Exact Test; P = 0.399

Table 2. Affection at 3 month quality of life

QOL score	Control group		Study group		Total	
	No.	%	No.	%	No.	%
1	27	60.00	31	68.89	58	64.44
2	13	28.89	14	31.11	27	30.00
3	5	11.11	0	0.00	5	5.56
Total	45	100.00	45	100.00	90	100.00

Chi-square = 5.313 with 2 degrees of freedom; P = 0.070

Table 3. Comparison of pain by VAS in both arms

Pain by VAS	Group	N	Mean	SD	Median	'p' Value*
Day 1	Study	45	2.13	1.08	2	0.007
	Control	45	3.29	1.71	2	
Day 2	Study	45	1.33	1.13	2	0.052
	Control	45	1.96	1.38	2	
Day 7	Study	45	0.13	0.50	0	0.001
	Control	45	0.91	1.00	0	
1 Month	Study	45	0.00	0.00	0	0.045
	Control	45	0.49	0.87	0	
3 Month	Study	45	0.00	0.00	0	0.069
	Control	45	0.44	0.84	0	

* Mann-Whitney Rank Sum Test

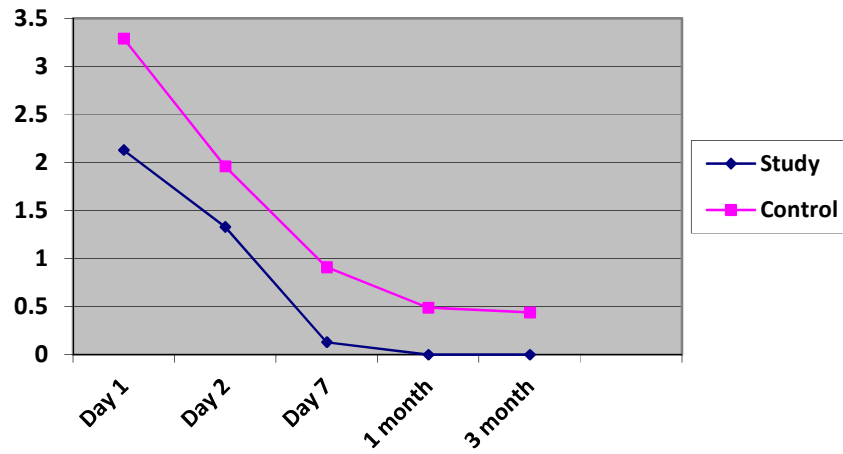


Fig. 4. Comparison of pain by mean VAS at various time periods

Table 4. Comparison of abduction deformity in both arms

Abduction deformity	Group	N	Mean	SD	Median	'p' Value*
Day 1	Study	45	2.62	0.49	3	0.365
	Control	45	2.51	0.51	3	
Day 7	Study	45	2.87	0.34	3	0.102
	Control	45	2.67	0.48	3	
1 Month	Study	45	3.00	0.00	3	0.102
	Control	45	2.80	0.40	3	
3 Month	Study	45	3.00	0.00	3	0.045
	Control	45	2.76	0.43	3	

* Mann-Whitney Rank Sum Test

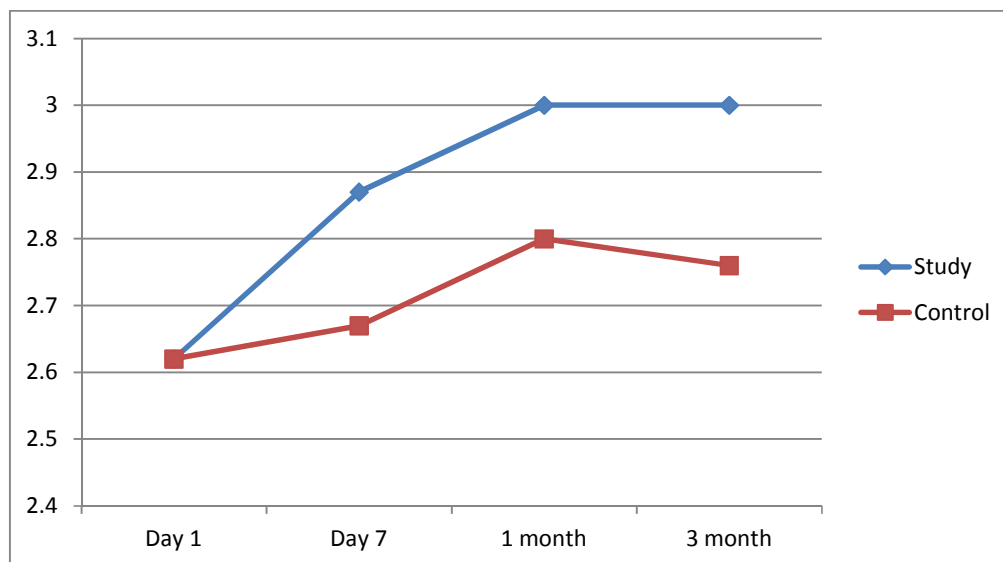


Fig. 5. Comparison of abduction deformity at various time periods

At day 1 the abduction deformity was comparable in both the arms. $P=0.365$

At day 7 the abduction deformity was comparable in both the arms. $P=0.102$

At one month the abduction deformity was comparable in both the arms. $P=0.102$

At 3rd month the abduction deformity was more in control arm as compare to test arm. $P=0.045$

Table 5. Affection QOL at 3rd month in both the arms

Group	N	Mean	SD	Median	'p' Value*
Study	45	1.31	0.47	1	0.314
Control	45	1.51	0.69	1	

* Mann-Whitney Rank Sum Test

Twenty seven patients (60%) in control arm and 31 patients (68.89%) in test arm could lift weights (Grade 1). Thirteen patients (28.99%) in control arm and 41 patients (31.11%) in test arm could perform house hold chores without any difficulty. Five patients (11.11%) in control arm and none patient in test arm had grade 3 that is difficulty in combing hair.

There was no difference in quality of life at end of 3 months in both the arm.

4. DISCUSSION

4.1 Age and Sex Distribution

In a study by Arulalan et al. [4] on 40 patients in 2016, Comparison of spinal accessory dysfunction following neck dissection with harmonic scalpel and electrocautery – A randomized study, the mean age was 48 years in electrocautery arm and 45.5 yrs in harmonic arm. Which is comparable to our study (50 and 52 yrs respectively).

The male to female ratio was 3.44:1, which is not different from our study (2.7:1). Showing the same trend in Indian population.

In a study by Sheno R et al. [5] on 295 patients in 2010, mean age of patients of oral cancer was found to be 49.73 years, comparable to our study.

Similarly the male to female ratio was 4.1:1, showing a trend towards male predominance.

To compare with western world as per US National Cancer Institute SEER program, the mean age of diagnosis of oral cancer is 65 years [6].

That is at least a decade earlier then western world, so we would like to state here that, ease at which tobacco and its related products are available at very affordable prices at the grocery stores and *paan* or betel quid kiosks is leading to people adopting this pernicious habit in our country that to at very early age.

The Karnofsky Performance Scale (KPS) score is a widespread metric to stratify patient

prognosis, morbidity and determine appropriate management in Head and Neck surgery. Low preoperative KPS values have been associated with delayed recovery of Spinal Accessory nerve. So in our study we had chosen the patient with KPS 90 to rule out any factor which can affect the outcome of study in terms of patient's functional condition. Both the arms in our study had a KPS of 90, so ruling out any kind of functional differences in the selected population under study.

4.2 Histology

The most common histology was squamous cell carcinoma in our study, which is similar to the study done by Arulalan et al. [4] on 40 patients in 2016, Comparison of spinal accessory dysfunction following neck dissection with harmonic scalpel and electrocautery – A randomized study. Study done in year 2012 by Ramachandra NB³¹ "The Hierarchy of oral cancer in India" and in 2010 a study by Sheno R et al. [5] the most common histopathology was squamous cell carcinoma. The other reported histology are salivary gland tumors, lymphomas and mucosal melanomas.

4.3 Stage Distribution

In our study group 20 patients (22.2%) had pathological stage I disease while 36.67%, 30% and 11.11% of the patients had stage II, III and IVA disease, respectively. In a study by Jatin P. et al. [7] on, "The Patterns of Cervical Lymph Node Metastases From Squamous Carcinoma of the Oral Cavity", out of total 512 patients, 19%, 29%, 36% and 16 % of the patients had stage I, II, III and IV disease, respectively.

In a study by Liao CT, et al. [8] "Tongue and buccal mucosa carcinoma: is there a difference in outcome?", patients with tongue and buccal mucosa had stage I, II, III and IV disease in 23.7%, 28.3%, 20.2%, 17.9% and 12%, 25.6%, 22.9%, 39.6% of the patients, respectively.

The study done by Arulalan et al. [4] on 40 patients in 2016, the major population belonged to the stage IV, that is 85% of the patients.

More number of patients with advanced stage IV A in above said study groups can be because of ignorance, low education and social stigmas. In our study the two arms had comparable distribution of patients with majority being T2, T3 lesion accounting for approximately 70% of the patient population.

4.4 Pattern of Nodal Disease

In our study patients (22.44%) had N0 disease, 49 patients that is 54.44% had N1 disease and 19 patients (21.11%) had N2 disease. None of patients had more than N2 nodal status. Because by the criteria of inclusion only selective nodal dissection patients were included and majority of N3 patients had undergone radical neck dissection.

In the two arm in our study the N0 & N1 disease was more common in control arm (84.44%). and in test arm N1, N2 Disease was more prevalent (90%).

In the study done by Arulalan et al. [4] on 40 patients in 2016, Comparison of spinal accessory dysfunction following neck dissection with harmonic scalpel and electrocautery – A randomized study, they had majority of nodal burden of N2 in each arm that is total of 34 patients that is 85%, it is comparable with our study.

4.5 Distribution of Subsite of Origin of Carcinoma in Oral Cavity Squamous Cell Carcinoma

In our study population, the most common subsite for origin of squamous cell carcinoma in oral cavity was buccal mucosa (GB sulcus), accounting for 5 patients (38.89%) of the patients. It was followed by carcinoma of tongue (31 patients, 34.4%), lower alveolus (36 patients, 16.4%), floor of mouth and lip (11 patients each, 12.22%), hard palate (2 patient, 2.22%) respectively.

In a study by Jatin P. et al. [7] most common subsite of origin of primary carcinoma in oral cavity was oral tongue (36%) followed by floor of mouth (33%) gums (21%) and retromolar trigone (5%) respectively.

In the study done by Arulalan et al. [4] on 40 patients, 21 (52.5%) patients had carcinoma of tongue and 14 (35%) patients had carcinoma of buccal mucosa which was comparable to our study.

In all study groups, buccal mucosa and tongue were the most common sub-site of origin of carcinoma, probably due to higher incidence of chewable tobacco consumption and keeping tobacco in gingivobuccal sulcus.

The two arms in our study were comparable in terms of most common site involved (tongue and buccal mucosa, >70%).

4.6 The Type of Incision

Utility incision was the only incision used by the Chief Surgeon due to personal preferences. The simple idea behind it was that level 5 was not targeted and utility incision serves better to tackle level 1 to 4 nodes. It was based upon the early study done by Crile G. [9] in 1906. It avoided the area of posterior triangle of neck which is notorious during raising the flap and causing the injury to nerve when it enters the trapezius muscle.

4.7 Requirement of Oral NSAIDs after 48 Hours

In our study 47 patients (52.22%) did not require post-op analgesia after 48 hours; only 43 patients (47.78%) complained of pain and oral NSAIDs were continued.

Upon comparison, though the VAS score at 48 hours was 1.33 ± 1.13 and 1.96 ± 1.38 in study and control arm respectively, but the requirement of NSAIDs were more in study arm than test arm (19 v/s 24 patients that is 42.22% v/s 53.33%). And 26 v/s 21 patients that is 57.78% v/s 46.67% did not require any analgesia after 48 hours in control and test arm respectively. $P=0.399$, that is not significant.

Similarly in a study by Arulalan et al. [4] in 40 patients, at 48 hours the pain score in HS group was 2.55 (10 patients, 50%) while in EC group 2.50 (9 patients that is 45%), this was found to be statistically non significant ($P=0.609$) and they concluded that “the patient who underwent surgery by harmonic scalpel had relatively lesser pain compared to those with electro cautery at 48 hours”. It could be justified with the study by Beriat et al. [10], in his study its reported that the mean maximum temperature values of surrounding tissues was $93.93 \pm 2.76^\circ\text{C}$ for the monopolar electrocautery group and $108.23 \pm 7.64^\circ\text{C}$ for the ultrasonic scalpel group. This could be the reason for more pain observed in the early post operative period in the harmonic scalpel group as compared to electrocautery.

In contrast to our study and above said study by Arulalan et al., a study by Ferri et al. [11] on 61 patients who showed a significant reduction in pain score at 48 hours with no requirement of NSAIDs in patients operated with harmonic scalpel as compared to electro cautery, $P=0.001$ with the mean VAS of 1.76 v/s 3.99 in harmonic and electrocautery group respectively. Shoulder pain at follow up was assessed at the end of 1st week, 1st month and 3rd month.

At the end of 1st week the mean VAS score of HS group was 0.13 ± 0.50 while that of EC group was 0.91 ± 1.00 (p value 0.001) which was statistically significant. At 1st month, mean VAS score of HS group was 0.00 and EC group was 0.49 ± 0.87 (p value 0.045) which was significant. At 3rd month VAS score in HS group was 0.00 whereas in EC group it was 0.44 ± 0.84 , p value 0.69, which was found to be not statistically significant.

This shows that during 1st week and 1st month pain was significantly less in HS arm as compare to EC arm indicating that use of harmonic is associated with less morbidity to patients. This also shows that with time the pain in EC arm reduces and almost equals the HS arm but despite that minimal shoulder pain remains in the electro cautery group even after 3 months of selective neck dissection.

This is in contrast to the study by Arulalan et al. [4] In their study shoulder pain at follow up was assessed at 1 week, 1 month, 3 month and 6 month. At 1 week, mean VAS score of HS group was 2.15 ± 1.461 and EC group was 3.30 ± 1.689 (P value 0.137) which was not significant (contrast to our study). At 1 month the mean VAS score of HS group was 0.70 ± 1.174 while EC group it was 0.85 ± 1.226 (P value 0.840) which was statistically non significant (contrast to our study). At 3 month VAS score in HS group was 0.00 whereas in EC group it was 0.40 ± 0.68 , P value 0.00, which was found to be statistically significant (contrast to our study). At 6 months the mean VAS score in HS group was 0.00, while in EC group it was 0.15 ± 0.366 with P value 0.00, which was statistically significant. This shows some persisting shoulder pain remains in the electro-cautery group even after 6 months of selective neck dissection. This could be made understood by the study by Emam TA et al. [12], that lateral thermal injury at the surgical site with harmonic scalpel was less than <1.5 mm as compared to electrocautery which was 15 mm. This could be the reason for persisting pain even

after 3 months after neck dissection with electrocautery.

4.8 Abduction Deformity at Day 1

In our study at day 1, no Grade 1 deformity was seen in both the arms. Grade 2 deformity was seen in 22 (48.89%) patients and 17 (37.78%) patients in control and study arm respectively. Whereas grade 3 deformity was seen in 23 (51.11%) patients and 28 (62.22%) patients in control and study arm respectively. This is not statistically significant $P=0.395$.

This is in contrast to study by Arulalan et al. [4] in his study grade 1 deformity was seen in 4 patients in harmonic group and no patients in Electrocautery group.

In HS group 4 patients had grade I, 7 patients had grade II and 9 patients had grade III abduction while in the EC group no patient had grade I abduction, 7 had grade II and 13 had grade III shoulder abduction, with p value 0.94 which was also statistically not significant [4].

Study by Ferri et al. [11] also showed a similar statistically non significant effect of either method on the shoulder function. This shows similar effect of both harmonic scalpel and electrocautery on the spinal accessory nerve during selective neck dissection.

The idea behind the shoulder function assessment in the immediate post operative period was; to identify the unwanted nerve stimulation and damage caused by the device that is being used in the vicinity of the spinal accessory nerve during the selective neck dissection. Our observations showed no increased hazardous effect of harmonic scalpel on the spinal accessory nerve in the immediate postoperative period. ($P=0.395$).

This is in contrast to study by Ferri et al. [11] and Arulalan et al. [4] where immediate post op harmonic scalpel caused more hazardous effect on the nerve. It could be justified with the study by Beriat et al. [10], in his study its reported that the mean maximum temperature values of surrounding tissues was $93.93 \pm 2.76^{\circ}\text{C}$ for the monopolar electrocautery group and $108.23 \pm 7.64^{\circ}\text{C}$ for the ultrasonic scalpel group. This could be the reason for more abduction deformity observed in the early post operative period in the harmonic scalpel group as compared to electrocautery.

4.9 Abduction Deformity at Day 7

In our study at day 7, no grade 1 deformity seen. Grade 2 deformity was seen in 15 (33.33%) patients and 6 (13.33%) patients in control and study arm respectively. Whereas grade 3 deformity was seen in 30 (66.67%) patients and 39 (86.67%) patients in control and study arm respectively. This is statistically significant $P=0.045$.

This is in contrast to study by Arulalan et al. [11] where at 1st week HS group had 3 patients with grade I, 9 patients with grade II and 8 patients with grade III; in EC group 2 patients had grade I, 7 patients had grade II and 11 patients had grade III abduction.

But both the study showed that harmonic scalpel use was associated with early recovery of shoulder function as compare to electrocautery.

4.10 Abduction Deformity at One Month

In our study at one month, no Grade 1 deformity seen in both the arms. Grade 2 deformity was seen in 9 (20%) patients and 0 (0.00%) patients in control and study arm respectively. Whereas grade 3 deformity was seen in 36 (80%) patients and 45 (100%) patients in control and study arm respectively. This is statistically significant ($P=0.003$).

This is in contrast to the study by Arulalan et al. [4] in which at 1 month 5% patients had grade I, 25% had grade II and 70% had grade III shoulder abduction in HS group; while in EC group none of the patients had grade I, 40% had grade II and 60% had grade III abduction.

4.11 Abduction Deformity at 3rd Month

In our study the harmonic arm continued to improve and attained grade 3 function but electrocautery arm 11 patients that is 24.44% had grade 2 deformity which was 2 patients more than the one month observation. And grade 3 deformity was seen in 4 patients. So the electrocautery group didn't worsen except 2 patients. $P<0.001$.

In the study by Arulalan et al. [4] at 3 months 1 patient had grade I, 3 patients had grade II and 16 patients had grade III shoulder abduction in the HS group while in EC group 6 patients had grade II and 14 had grade III. In this study also both the groups were recovering but harmonic

group improved significantly, similar to our study except that they still had one grade 1 deformity patient in harmonic group.

To summarize the abduction deformity, our study suggests that the reduction in shoulder function by harmonic scalpel is relatively temporary and almost complete recovery is attained at 3 months as compared with electrocautery ($P=0.45$). The reason behind this could be due to fact that less amount of energy is delivered to the neighbouring tissues with harmonic scalpel than when using electrocautery. Moreover the lateral thermal damage and deeper tissue damage have been shown to be lower in harmonic scalpel as compared to electrocautery [12,13] resulting in less surgical stress to surrounding tissue and early healing in harmonic scalpel group.

4.12 Visible Loss of Muscle Mass/ Atrophy/Winging of Scapula at the End of 3rd Month

Both the group was comparable at the end of 3 months with 100% recovery as compare to opposite limb. It is because selective neck dissection causes lesser shoulder dysfunction when compared to other types of neck dissections due to lesser degree of level V manipulation during the surgical procedure resulting in less damage to the accessory nerve and the neck plexus.

In the study by Arulalan et al. [4], similar results were attained by the end of 6 month. The time duration in their study was more this could be due to the contact time used by the devices at the time of dissection. As shown in the study by Hefermehl LJ et al. [13], they stated that monopolar instruments exhibited a mean critical thermal spread of 3.5 (2.3) mm when applied for 1 sec. After 2 sec, the increase in spread was >20 mm. in contrast, the spread of the harmonic instrument for 1 and 2 seconds was 1.3 (0.2) and 1.6 (0.3) mm respectively ($P = 0.03$).

4.13 3rd Month Quality of Life (QOL)

In our study we added QOL as a parameter showing effect of the energy instruments upon patient's daily life. So in control group 27 (60%) patients and in test arm 31 (68.89%) patients had good quality of life that is grade 1. 13 (28.89%) and 14 (31.11%) patients had grade 2 QOL in EC and HS arm respectively. 5 (11.11%) patients had grade 3 QOL in EC arm and none in HS arm, although this was not statically significant. ($P=0.056$).

So at the end of 3rd month QOL was not statistically significant with a P value of 0.07. The mean affection of QOL at 3rd month in HS group was 1.31±0.47 and in EC group 1.51±0.69 which is not statistically significant. (P=0.314).

So to conclude after 3 months the quality of life from patient's perspective was same irrespective of the instruments used.

4.14 Duration of Neck Dissection in Minutes

The mean duration of neck dissection in EC group was 69.78±8.98 minutes and in HS group was 90.33±13.75 minutes (P=<0.001).

This signify that time taken in surgery was increased when HS was used as compare to EC as harmonic scalpel is slow to use and time consuming. But this can be overcome by the time and practice.

5. CONCLUSION

We concluded from our study that though the technique of neck dissection (harmonic v/s electro cautery) has significant impact on shoulder dysfunction. Despite that in postoperative period shoulder function measured by way of shoulder pain and shoulder abduction recover almost fully during follow-up period without causing significant morbidity and with minimal effect on quality of life. There are few recommendations we would like to suggest that if incorporated, they might significantly affect the outcome and better results.

Nerve conduction study and electromyogram should be added in the study to get a better objective outcome, although it will increase the treatment cost to the patient. Use of temperature probes/video-thermography to assess the thermal spread to the surrounding structures can also be added.

Also use of enzymatic assessment of temperature spread by evaluation of thermal damage at the protein level can be done which requires a modified lactate dehydrogenase (LDH) assay. As a ubiquitous Krebs-cycle protein, LDH is an established marker for cell damage.

Creating a heat sink effect by using cold saline during use of energy instruments. Will it decrease the damage and lateral spread of heat?

Will it be feasible to get a muscle biopsy to document and prove the atrophy of muscle? These are some of the questions that can be answered only by conducting further studies involving a significant number of patients.

CONSENT

As per international standard, patient's written consent has been collected and preserved by the author(s).

ETHICAL APPROVAL

Ethical approval was obtained from the ethical committee of the institution.

COMPETING INTERESTS

Authors have declared that no competing interests exist

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