Section: Miscellaneous

Original Research Article

# FUNCTIONAL ASSESSMENT OF RANGE OF SHOULDER ABDUCTION AFTER NECK DISSECTION: A PILOT STUDY

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***Received*** *: 03/09/2025*
***Received in revised form*** *: 18/10/2025*
***Accepted*** *: 05/11/2025*

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**DOI:** 10.70034/ijmedph.2025.4.220

**Source of Support:** Nil,
**Conflict of Interest:** None declared

**Int J Med Pub Health**
2025; 15 (4); 1226-1230

ABSTRACT

**Background:** Neck dissection is essential for managing head and neck cancers but poses risks to the spinal accessory nerve (SAN), leading to shoulder dysfunction. This study aims to evaluate shoulder abduction in patients post-neck dissection, informing better preoperative planning and targeted rehabilitation strategies.

**Materials and Methods:** This pilot study included 20 patients with head and neck cancer undergoing neck dissection at a tertiary care hospital. Inclusion criteria were patients of both sexes undergoing neck node dissection and providing informed consent. Exclusion criteria included preoperative shoulder pathology, revision surgeries, neoadjuvant chemotherapy, and lack of consent. Range of Motion Shoulder Abduction was assessed using a goniometer. Postoperative assessments occurred at 1 week, 4 weeks, and 12 weeks after starting Physiotherapy on Post Op Day 2.

**Results:** Five patients underwent Bilateral Type 3 Neck Dissection. Of the remaining, 11 had Ipsilateral Type 3 Neck Dissection (6 with contralateral Selective Neck Dissection as well), and 4 had Ipsilateral Selective Neck Dissection (1 with contralateral Selective Neck Dissection as well). Significant improvements in shoulder function were observed over 12 weeks postoperatively. The mean pre-operative shoulder abduction was 158.40 degrees, decreasing to 120.65 degrees at 1 week, improving to 143.05 degrees at 4 weeks, and 147.25 degrees at 12 weeks.

**Conclusion:** This study highlights the significant impact of neck dissection on shoulder function and pain, emphasizing the importance of early and consistent postoperative rehabilitation. Targeted physiotherapy significantly improves outcomes, underscoring the need for a multidisciplinary approach to optimize recovery.

**Keywords:** Neck Dissection, Shoulder Abduction, Rehabilitation, Spinal Accessory Nerve, Postoperative Recovery.

## INTRODUCTION

The primary objective of cancer therapy is to achieve a secure outcome in terms of oncology. However, it is essential to also consider the enhancement of the patient's quality of life following an extensive surgical procedure. Neck dissection plays a crucial role in the treatment of Head-Neck-Face cancer, not only in terms of the impact on appearance but also in terms of the potential negative effects in the short and long term. For many years, radical neck dissection has been considered the standard approach to address neck metastases. However, in modern cancer surgery, the trend is to prioritize the eradication of tumours while minimizing the possible consequences in the short and long term. With this perspective in mind, modified radical neck dissections and selective neck

dissections, are performed whenever feasible. Incurring damage or sacrificing the spinal accessory nerve can result in denervation and the wasting of the trapezius muscle, leading to shoulder disability. Patients may experience shoulder droop, pain, weakness, and limited range of motion. The Spinal Accessory Nerve, or the Eleventh Cranial Nerve, supplies the Sternocleidomastoid and Trapezius Muscles. The latter helps in Shoulder Abduction. In modified radical neck dissection and selective neck dissection, the manipulation of the spinal accessory nerve is reduced. This factor may contribute to better subjective outcomes for patients and a decrease in morbidity following such an invasive surgery.

## MATERIALS AND METHODS

This study aimed to study the range of motion of shoulder abduction after neck dissection in patients operated for Head and Neck Carcinoma(s) with the objective of evaluating the cause for any post op shoulder abduction morbidity in post neck dissection Patients. The study included a cohort of 20 patients diagnosed with head and neck cancer who required neck dissection as part of their treatment plan. Inclusion criteria were patients of both sexes undergoing any type of neck node dissection for head and neck carcinomas, and those providing valid and informed consent to participate in the study. Exclusion criteria included patients with preoperative shoulder pathology affecting range of motion, revision head and neck carcinoma patients planned for surgery, head and neck carcinoma patients undergoing or who have taken neoadjuvant chemotherapy, and those not providing valid and informed consent to participate in the study. Ethical approval was obtained from the institutional review board, and all participants provided written informed consent. All patients in the study underwent thorough clinical examination and were evaluated for shoulder function preoperatively. Range of motion of shoulder abduction was documented pre-operatively using Goniometer. Peri-operatively, nerve handling like nerve stretching, cauterisation of tissues or vessels around the nerve was documented. Limb Physiotherapy was started on the 2nd Post Op Day and patients were revaluated for the amplitude of shoulder abduction in the first week post-operatively, and the values monitored and documented. Physiotherapy was continued for the patients and further evaluation was done on the 4th and 12th week on follow up. All the symptoms were assessed. Pre-operative and Post-operative Range of Shoulder Abduction movements were documented and range of abduction was quantified and compared.

## RESULTS

Out of the 20 patients in this study, 14 patients were male (70%) and 6 patients were female (30%). The mean pre-operative shoulder abduction was 158.40 degrees, with a very low standard deviation (SD = 2.30), indicating minimal variation among patients.

5 patients underwent Bilateral Type 3 Modified Neck Dissection. 11 patients underwent Ipsilateral Type 3 Modified Neck Dissection (6 of which underwent contralateral Selective Neck Dissection as well). 4 patients underwent Ipsilateral Selective Neck Dissection (1 of which underwent Contralateral Selective Neck Dissection as well).

After limb physiotherapy was started on Post-Operative day 2, Range of shoulder abduction was measured in the first week and 14 patients experienced a reduced range of shoulder abduction and 11 patients complained of shoulder pain. The mean shoulder abduction significantly decreased to 120.65 degrees (SD = 31.94), reflecting the immediate impact of the surgery.

Limb physiotherapy was continued, and range of shoulder abduction was measured on 4$^{th}$ and 12$^{th}$ week on follow-up. By 4 weeks post-operative, the mean shoulder abduction improved to 143.05 degrees (SD = 26.52), and further increased to 147.25 degrees (SD = 23.11) at 12 weeks. The improvements over time were statistically significant, demonstrating effective recovery and rehabilitation. 2 patients experienced a reduced range of shoulder abduction and 1 patient complained of shoulder pain and joint stiffness.

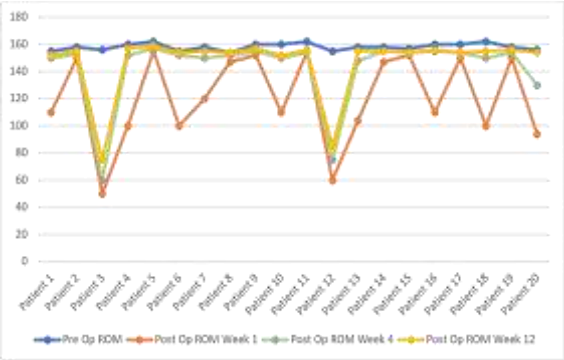


**Figure 1: Comparisons of Range of Shoulder Abduction Pre-Operatively and Post-Operatively on 1$^{st}$ week, 4$^{th}$ week and 12$^{th}$ week**

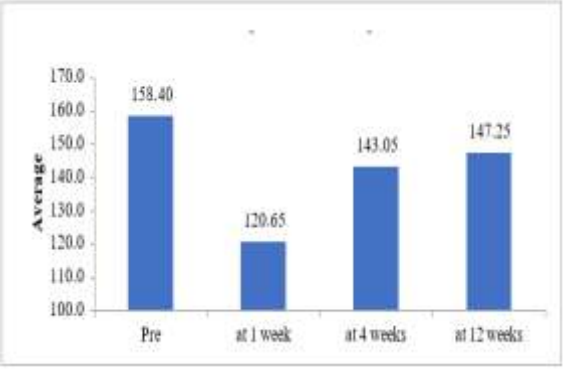


**Figure 2: Comparison of Pre-operative and Post-operative Shoulder Abduction (Degrees)**

**Table 1: Comparative Analysis of Pre-operative and Post-operative Shoulder Abduction (Degrees) at Various Time Points**

| Shoulder abduction | N | Mean | SD | Median | Min | Max | F-stat | p-value |
|---|---|---|---|---|---|---|---|---|
| Pre | 20 | 158.40 | 2.30 | 158.00 | 155.00 | 162.00 | 1075.36 | <.001** |
| at 1 week | 20 | 120.65 | 31.94 | 115.00 | 50.00 | 155.00 | | |
| at 4 weeks | 20 | 143.05 | 26.52 | 152.00 | 60.00 | 157.00 | | |
| at 12 weeks | 20 | 147.25 | 23.11 | 154.00 | 75.00 | 159.00 | | |

## DISCUSSION

Spinal accessory nerve (SAN) damage is a common co-occurring condition following neck dissection in patients with head and neck cancers (HNCs).[1,2] In the past, radical neck dissection,[3] was the standard surgical technique for patients with HNCs who had neck lymph node metastasis.[4] However, this method resulted in complete SAN damage, which is associated with significant pain and dysfunction in the shoulder on the same side, and may have negative effects on the overall quality of life.[5-8] Selective neck dissection (SND) was done to potentially reduce the complications of the surgery. Nevertheless, even with Selective Neck Dissection, up to 67% of patients have reported Spinal Accessory Nerve damage.[2,9] The trapezius muscle plays a major role in maintaining the position of the scapula and assisting with shoulder abduction and flexion. Therefore, injury to the accessory nerve can result in weakness of the trapezius muscle, leading to misalignment of the scapula during depression, abduction, and medial rotation, as well as limited shoulder abduction and flexion.[10,11,12] The occurrence of shoulder pain, shoulder dysfunction, and changes in quality of life after surgery are influenced by the type of neck dissection performed.[13]

With this background the present study was conducted and the following is a discussion of findings of our study with that of already existing literature to see for generalizability of results. Out of 20 patients, 2 patients experienced a reduced range of motion of shoulder abduction post-operatively on 12th week follow-up. The first patient underwent Right Composite Resection with Right Type 3 Modified Radical Neck Node Dissection with reconstruction with Right Supraclavicular Fasciocutaneous Flap. The patient also experienced Shoulder Pain and Joint Stiffness. This result can be compared with another similar study by Huand YC et al,[14] where 18 patients underwent SND, there were significant decrease in thickness of trapezius muscle (p=0.001), abnormal findings of supraspinatus tendon (p=0.022), and subdeltoid bursa (p=0.018) on surgical side. The ratio of trapezius muscle atrophy was related to shoulder pain (p=0.010). Patients with subdeltoid abnormalities had significant limitation on shoulder flexion and abduction. Abnormalities of supraspinatus tendon and subdeltoid bursa on sonography and trapezius muscle atrophy may play a key role in shoulder pain and shoulder flexion and abduction limitations. This is a limitation for our study as we have not assessed these parameters.

The second patient underwent Subtotal Glossectomy with Bilateral Type 3 Modified Radical Neck Node Dissection with Reconstruction with Right PMMC Flap. On Retrospective evaluation, we hypothesize that prolonged peri-operative nerve stretching and tissue cauterization around the nerve needed during the neck dissection may have attributed to the reduced range of shoulder abduction post-operatively.

The importance of starting Limb Physiotherapy post-operatively was highlighted in a study by Salerno et all,[15] where patients who were started on physical therapy post neck dissection had better results concerning passive forward elevation (P = 0), shoulder active motility (P = 0), pain (P <.001), working and recreational activity (P = 0), and Electromyography work-up showed deterioration in early postoperative periods and improvements in late postoperative periods. They concluded that the post-surgical clinical picture of shoulder disability is influenced not only by accessory nerve injury but also by secondary glenohumeral stiffness. This stiffness results from weakness in the scapulohumeral girdle muscles and enforced immobility after surgery. Physical therapy, which focuses on restoring passive motion and preventing joint fibrosis, plays a significant role in reducing shoulder complaints. Another study by McGarvey et al. (2015) aimed at maximizing shoulder function after accessory nerve injury during neck dissection, demonstrating the efficacy of targeted physiotherapy in improving shoulder outcomes.[16] The initial reduction in strength and associated pain can be attributed to surgical trauma and inflammation, while the subsequent improvement underscores the role of rehabilitation in muscle recovery and strength enhancement.[17] Similarly, McGarvey et al. (2015) and Cappiello et al. (2005) stressed the importance of early physical therapy interventions in mitigating shoulder dysfunction post neck dissection.[16,18]

Güldiken et al. (2005) assessed shoulder impairment following functional neck dissection and found long-term shoulder dysfunction in patients, indicating the need for effective postoperative rehabilitation.[19] The Brazilian Head and Neck Cancer Study Group (1999) compared elective lateral neck dissection with type III modified radical neck dissection, highlighting the superior functional outcomes and reduced shoulder morbidity associated with elective lateral neck dissection.[20] Similarly, Zhang et al. (2004) evaluated selective neck dissection and observed better functional outcomes in terms of shoulder mobility compared to more extensive neck dissections.[21] Kuntz and Weymuller (1999) examined the impact of

neck dissection on quality of life and identified significant decreases in shoulder function and overall well-being post-surgery.[22] This finding is consistent with Stuiver et al. (2008), who reported that shoulder complaints significantly impact shoulder disability and quality of life, emphasizing the importance of addressing these issues during postoperative care.[23]

Our findings regarding range of movement are somewhat similar to findings from the study of Imai T et al,[24] where the average active shoulder abduction angles were significantly improved at 3 and 6 months postoperatively compared with 1 month postoperatively (96.5 ± 4.3° at 1 month versus 110.1 ± 4.7° at 3 months, $p = 0.035$, and versus 142.0 ± 4.6° at 6 months, $p < 0.0001$). The proportion of patients who were unable to abduct their shoulders by 150° or more was significantly lower at 6 months postoperatively (41.5%) compared with 1 month postoperatively (82.4%, $p < 0.0001$). The WORC score significantly improved from 60.4 ± 2.4% at 1 month postoperatively to 67.9 ± 2.6% at 6 months postoperatively ($p = 0.036$).

Eickmeyer et al. (2014) supported these findings by demonstrating the long-term impact of neck dissection on shoulder range of motion and quality of life in cancer survivors.[10] Umeda et al. (2010) examined shoulder mobility after spinal accessory nerve-sparing modified radical neck dissection and reported improved functional outcomes, highlighting the benefits of nervesparing techniques.[25]

Overall, this study highlights the critical importance of early rehabilitation and consistent postoperative care in facilitating recovery and improving functional outcomes for patients undergoing neck dissection. These findings align with literature that underlines the necessity of integrating physiotherapy and tailored postoperative interventions to mitigate the adverse effects of neck dissection on shoulder function and pain. The collective evidence from these studies highlights the need for a multidisciplinary approach to patient care, ensuring comprehensive support and optimal recovery for individuals undergoing neck dissection surgeries thereby reducing post-operative morbidity.

## CONCLUSION

This study highlights the significant impact of neck dissection on shoulder function and pain, indicating the effectiveness of early and consistent postoperative rehabilitation. Targeted physiotherapy significantly improves shoulder abduction, strength, and pain levels, highlighting the need for a multidisciplinary approach to optimize recovery, enhance patient outcomes and reduce post-operative morbidity.

**Conflicts of Interest:** None
**Funding source:** None.

## REFERENCES

1. McGarvey A. C., Hoffman G. R., Osmotherly P. G., Chiarelli P. E. Maximizing shoulder function after accessory nerve injury and neck dissection surgery: A multicenter randomized controlled trial. Head & Neck. 2015;37(7):1022–1031. doi: 10.1002/hed.23712.
2. van Wilgen C., Dijkstra P., van der Laan B., Plukker J., Roodenburg J. Shoulder complaints after neck dissection; is the spinal accessory nerve involved? British Journal of Oral and Maxillofacial Surgery. 2003;41(1):7–11. doi: 10.1016/S02664356(02)00288-7.
3. Crile G. Excision of cancer of the head and neck. With special reference to the plan of dissection based on one hundred and thirty-two operations. By George Crile. JAMA. 1987;258:3286– 3293.
4. Umeda M., Shigeta T., Takahashi H., et al. Shoulder mobility after spinal accessory nerve–sparing modified radical neck dissection in oral cancer patients. Oral Surgery, Oral Medicine, Oral Pathology, Oral Radiology, and Endodontology. 2010;109(6):820–824.doi: 10.1016/j.tripleo.2009.11.027.
5. Dijkstra P. U., van Wilgen P. C., Buijs R. P., et al. Incidence of shoulder pain after neck dissection: A clinical explorative study for risk factors. Head & Neck. 2001;23(11):947–953. doi: 10.1002/hed.1137.
6. Inoue H., Nibu K., Saito M., et al. Quality of life after neck dissection. Archives of Otolaryngology–Head & Neck Surgery. 2006;132(6):662–666. doi: 10.1001/archotol.132.6.662.
7. Kuntz A. L., Weymuller Jr E. A. Impact of neck dissection on quality of life. The Laryngoscope. 1999;109(8):1334–1338. doi: 10.1097/00005537-199908000-00030.
8. Stuiver M. M., van Wilgen C. P., de Boer E. M., et al. Impact of shoulder complaints after neck dissection on shoulder disability and quality of life. Otolaryngology–Head and Neck Surgery. 2008;139(1):32–39. doi: 10.1016/j.otohns.2008.03.019.
9. van Wilgen C., Dijkstra P., van der Laan B., Plukker J., Roodenburg J. Shoulder complaints after nerve sparing neck dissections. International Journal of Oral and Maxillofacial Surgery. 2004;33(3):253–257. doi: 10.1006/ijom.2003.0507.
10. Eickmeyer S. M., Walczak C. K., Myers K. B., Lindstrom D. R., Layde P., Campbell B. H. Quality of life, shoulder range of motion, and spinal accessory nerve status in 5year survivors of head andneck cancer. PM & R : The Journal of Injury, Function, and Rehabilitation. 2014;6(12):1073–1080. doi: 10.1016/j.pmrj.2014.05.015.
11. Güldiken Y., Orhan K. S., Demirel T., Ural H. İ., Yücel E. A., Değer K. Assessment of shoulder impairment after functional neck dissection: Long term results. Auris Nasus Larynx. 2005;32(4):387–391. doi: 10.1016/j.anl.2005.05.007.
12. McGarvey A. C., Chiarelli P. E., Osmotherly P. G., Hoffman G. R. Physiotherapy for accessory nerve shoulder dysfunction following neck dissection surgery: A literature review. Head & Neck. 2011;33(2):274–280. doi: 10.1002/hed.21366.
13. Laverick S., Lowe D., Brown J. S., Vaughan E. D., Rogers S. N. The impact of neck dissection on health-related quality of life. Archives of Otolaryngology–Head & Neck Surgery. 2004;130(2):149–154. doi: 10.1001/archotol.130.2.149.
14. Huang YC, Lee YY, Tso HH, Chen PC, Chen YC, Chien CY, Chung YJ, Leong CP. The Sonography and Physical Findings on Shoulder after Selective Neck Dissection in Patients with Head and Neck Cancer: A Pilot Study. Biomed Res Int. 2019 Jul 22;2019:2528492. doi: 10.1155/2019/2528492.
15. Salerno G, Cavaliere M, Foglia A, Pellicoro DP, Mottola G, Nardone M, Galli V. The 11th nerve syndrome in functional neck dissection. Laryngoscope. 2002 Jul;112(7 Pt 1):1299-307. doi: 10.1097/00005537-200207000-00029. PMID: 12169917.
16. McGarvey AC, Hoffman GR, Osmotherly PG, Chiarelli PE. Maximizing shoulder function after accessory nerve injury and neck dissection surgery: A multicenter randomized controlled trial. Head Neck. 2015 Jul;37(7):1022–31.
17. McGarvey AC, Chiarelli PE, Osmotherly PG, Hoffman GR. Physiotherapy for accessory nerve shoulder dysfunction

following neck dissection surgery: a literature review. Head Neck. 2011 Feb;33(2):274–80.
18. Cappiello J, Piazza C, Giudice M, De Maria G, Nicolai P. Shoulder disability after different selective neck dissections (levels II-IV versus levels II-V): a comparative study. The Laryngoscope. 2005 Feb;115(2):259–63.
19. Güldiken Y, Orhan KS, Demirel T, Ural HI, Yücel EA, Değer K. Assessment of shoulder impairment after functional neck dissection: long term results. Auris Nasus Larynx. 2005 Dec;32(4):387–91.
20. Brazilian Head and Neck Cancer Study Group. End results of a prospective trial on elective lateral neck dissection vs type III modified radical neck dissection in the management of supraglottic and transglottic carcinomas. Head Neck. 1999 Dec;21(8):694–702.
21. Zhang B, Tang P zhang, Xu Z gang, Qi Y fa, Wang X lei. [Functional evaluation of the selective neck dissection in patients with carcinoma of head and neck]. Zhonghua Er Bi Yan Hou Ke Za Zhi. 2004 Jan;39(1):28–31.
22. Kuntz AL, Weymuller EA. Impact of neck dissection on quality of life. The Laryngoscope. 1999 Aug;109(8):1334–8.
23. Stuiver MM, van Wilgen CP, de Boer EM, de Goede CJT, Koolstra M, van Opzeeland A, et al. Impact of shoulder complaints after neck dissection on shoulder disability and quality of life. Otolaryngol--Head Neck Surg Off J Am Acad Otolaryngol-Head Neck Surg. 2008 Jul;139(1):32–9.
24. Imai T, Sato Y, Abe J, Kumagai J, Morita S, Saijo S, Yamazaki T, Asada Y, Matsuura K. Shoulder function after neck dissection: assessment via a shoulder-specific qualityof-life questionnaire and active shoulder abduction. Auris Nasus Larynx. 2021 Feb 1;48(1):138-47.
25. Umeda M, Shigeta T, Takahashi H, Oguni A, Kataoka T, Minamikawa T, et al. Shoulder mobility after spinal accessory nerve-sparing modified radical neck dissection in oral cancer patients. Oral Surg Oral Med Oral Pathol Oral Radiol Endod. 2010 Jun;109(6):820–4.