

Original Research Article

Effectiveness of Stabilization Exercises with Mirror Feedback Versus Home Based Exercise Programme on Pain, Disability and Muscle Endurance in Salon professionals on Chronic Neck Pain

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**ABSTRACT**

Introduction: Chronic neck pain is common among Salon professionals due to prolonged static postures and repetitive upper-limb activities. Cervical stabilization and home-based exercises are commonly used physiotherapy interventions. This study compared the effectiveness of cervical stabilization exercises with mirror feedback and a home-based exercise program on pain, disability, and cervical muscle endurance in Salon professionals with chronic neck pain.

Methods: Thirty Salon professionals with chronic neck pain were enrolled and allocated by purposive sampling into two groups: cervical stabilization exercises with mirror feedback (n=15) and home-based exercises (n=15). The intervention group performed cervical stabilization exercises with real-time mirror feedback in different positions, while the control group followed a structured home-based exercise program. Pain and disability were assessed using the Neck Disability Index (NDI), and cervical muscle endurance was measured using a pressure biofeedback unit before and after the intervention.

Results: The intervention group showed a significant reduction in mean NDI scores from 26.4 to 17.8 (mean difference=8.6, $p<0.001$) and improvement in cervical muscle endurance from 24.5 to 28 (mean difference=3.5, $p<0.001$). The control group demonstrated a reduction in NDI scores from 24.87 to 15.13 (mean difference=10, $p<0.001$) and improved muscle endurance from 24.27 to 25.87 (mean difference=1.6, $p<0.001$). Both groups improved significantly, with greater gains in muscle endurance in the intervention group and slightly greater disability reduction in the control group.

Conclusion: Both interventions effectively reduced disability and improved outcomes in Salon professionals with chronic neck pain. Cervical stabilization with mirror feedback produced greater improvement in cervical muscle endurance.

Keywords: Cervical muscle endurance, Chronic neck pain, Home-based exercise, Mirror feedback.

INTRODUCTION

Salon technicians can offer many different services, including haircuts, eyebrow threading, hairstyling, facials, manicures, pedicures, and massages [1]. Their work has some time very specific requirements that involve excessive and prolonged flexing of the neck and trunk, repetitive upper limb movements and static postures, all of which can have an adverse impact on the cervical spine and its surrounding musculature [2]. Chronic neck pain refers to pain that lasts for more than three months and is mainly located in the cervical region (between the posterior C1 and anterior C7 vertebrae) [3]. The Global Burden of Disease Study 2021 estimates that neck pain resulted in ~28.6 million years lived with disability. The relationship between different physical and occupational factors and cervical disability and neck pain is very strong [4]. Neck pain is the most prevalent musculoskeletal complaint in the profession of Salon professionals and it has been identified as a high-risk group for developing neck pain [5]. The purpose of the stabilization exercises is to increase the neuromuscular control, endurance and coordination of the deep cervical muscles [6]. These exercises can be paired with mirror feedback to further augment proprioception and postural awareness, leading to improved movement precision, adherence and outcomes [7]. There is an option of home-based exercise programmes for long-term self-management, which is cost-effective and accessible, but may not be enough because there is some variation in adherence, and the lack of real-time correction or supervision may not be sufficient [8]. Although the physical demands of the salon trade are a large part of the job, they are an under researched population [9]. Their repetitive and posture dependent working habits make them vulnerable to chronic neck pain, decrease in cervical muscle endurance and functional disability [10]. This is an occupational trauma that can create a negative impact on their health as well as on their productivity and job satisfaction [11]. Exercise therapy is a common treatment for neck pain and exercises performed at home can be effective, but problems with adherence and lack of feedback on the exercises may limit the effectiveness of this treatment [12].

Mirror assisted stabilization exercises may help to improve head-neck alignment, deep cervical muscle control and functional outcomes by giving visual feedback for the postural corrective movements during the motor learning process [13]. There are however few studies directly comparing this approach to conventional home-based exercise programmes in high-risk occupational groups, like salon professionals [14]. Thus, it would be of interest to compare the effectiveness of the cervical stabilization exercises and mirror feedback with the exercise program at home on neck pain, disability, and cervical muscle endurance in Salon professionals with chronic neck pain. Neck Disability Index was used for assessment of pain and disability and the Pressure Biofeedback Unit was used for assessment of cervical muscle endurance.

METHODOLOGY

The comparative study was done among the female Salon professionals age group 20-40 years in Maval area's beauty salons. Thirty participants were selected by purposive sampling, and then allocated to two groups: Group A (n=15), who were given cervical stabilization exercises with mirror feedback, and Group B (n=15), who were given an exercise program at home using the McKenzie Method. Those who had chronic neck pain confirmed by an orthopaedic physician, a NDI score of 15-34 and over 1 year of professional experience and over 30 hours per week were included. Cervical radiculopathy, neurological diseases or prior surgery of the neck, shoulder or upper back were exclusion criteria.

Ethical approval was given by the Institutional Ethical Committee and the study was conducted in accordance with the Declaration of Helsinki (2013). The Ethical Clearance/Institutional Ethics Committee (IEC) approval number is (EC/NEW/INST/2019/377/294). All participants signed informed consent forms and confidentiality was maintained and participants had the right to withdraw at any time. Neck Disability Index (NDI) for neck pain-related disability and a Pressure Biofeedback Unit for cervical muscle endurance were used for baseline assessment. Both groups received a 4-week intervention 3 times per week for ~20 minutes per session including warm-up, exercise, and cool down. Group A did cranio-cervical flexion, cervical retraction

and isometric stabilization exercises using real-time mirror feedback to help improve posture and motor control. Exercises with focus on mobility, posture and endurance were performed on the McKenzie-based exercises in group B, such as chin tucks, cervical retraction, extension, lateral flexion and rotation. NDI and cervical muscle endurance assessments were performed post intervention, with all outcome measures the same.

RESULT

After the women were screened for eligibility, 30 with chronic neck pain were selected and randomly assigned to one of two equal groups: intervention (Salon professionals performing stabilization exercises combined with mirror feedback), and control (home-based exercise). SPSS version 25.0 was used for data analysis. Descriptive data was presented as mean $\pm$ SD and paired and unpaired t-test used to compare differences within and between groups, respectively. The level of p-value < 0.05 was regarded as statistically significant.

There was a statistically significant improvement in NDI scores and in cervical muscle endurance between both groups after the four-week intervention (all $p < 0.001$). As shown in Table 1, mean NDI scores decreased from 26.4 ± 5.4 to 17.8 ± 4.8 in the intervention group and from 24.87 ± 5.2 to 15.13 ± 5.0 in the control group. Likewise, the cervical muscle endurance (CMU)

improved from 24.53 ± 8.6 to 28.0 ± 9.2 in the intervention group and from 24.27 ± 8.3 to 25.87 ± 8.9 in the control group. The pre- and post-intervention changes in NDI are visually presented in Table 1 and the same changes in cervical muscle endurance are shown in Table 2.

There appeared to be comparable improvement between the groups with a difference of 8.6 points and 7.74 points in the intervention and control groups respectively (Table 2) but the difference was not statistically significant ($p = 0.06$). By contrast, there was greater improvement in cervical muscle endurance in the intervention group (3.47 s) than in the control group (1.6 s); between-group difference was statistically significant ($p = 0.002$; $r = 0.35$) in favor of stabilization exercises with mirror feedback (Table 2).

DISCUSSION

Thirty salon professionals who met the inclusion criteria with chronic neck pain were split into 2 groups of equal size: Group A received a protocol of cervical stabilization exercises with mirror feedback, and Group B received a structured, home based exercise programme. The two interventions took place for four weeks. The data was analyzed using SPSS version 25.0, which was used to compare the data between groups with an unpaired t test as well as within group changes with a paired t test, and was considered significant at $p < 0.05$.

Table 1: Comparison of Neck Disability Index (NDI) and cervical muscle endurance between groups before and after intervention

Outcome	Group	Pre-test (Mean $\pm$ SD)	Post-test (Mean $\pm$ SD)	p-value (paired t-test)	Result
NDI	Intervention	26.4 ± 5.4	17.8 ± 4.8	<0.001	Significant
NDI	Control	24.87 ± 5.2	15.13 ± 5.0	<0.001	Significant
Endurance (sec)	Intervention	24.53 ± 8.6	28.0 ± 9.2	<0.001	Significant
Endurance (sec)	Control	24.27 ± 8.3	25.87 ± 8.9	<0.001	Significant

Table 2: Comparison of mean Neck Disability Index (NDI) scores pre- and post-intervention in both groups

Outcome	Intervention Change (Mean)	Control Change (Mean)	p-value (unpaired t-test)	Result
NDI Improvement (points)	8.6	7.74	0.06	Comparable
Endurance Improvement (sec)	3.47	1.6	0.002	Superior (intervention)

The results showed both groups improved significantly; and the mirror feedback group showed better results for cervical muscle endurance. There was a significant decrease in the Neck Disability Index (NDI) scores in both groups after the intervention (intervention group 17.8 ± 4.8 to 26.4 ± 5.4 , $p < 0.001$ and control group 15.13 ± 5.0 to 24.87 ± 5.2 , $p < 0.001$) using group analysis with paired t tests, suggesting that both intervention groups were effective in reducing neck pain and disability [21]. Similarly, the cervical muscle endurance of the intervention group increased significantly from 24.53 ± 8.6 seconds to 28.0 ± 9.2 seconds ($p < 0.001$) and the control group increased from 24.27 ± 8.3 seconds to 25.87 ± 8.9 seconds ($p < 0.001$).

Analysis of between group differences (unpaired t test) revealed that the mirror feedback group gained significantly more in muscle endurance (between group mean difference of 3.47s compared with 1.6s in control group, $p = 0.002$, effect size $r = 0.35$), but there was no significant difference between the groups in improvements in pain and disability (NDI) ($p = 0.06$). These results indicate that there is an added benefit to visualization, in terms of improving neuromuscular control and fatigue resistance, over home-exercises alone, when used as an adjunct to stabilization training.

Mirror feedback gives instant visual feedback of the postural position and accuracy of movement to enable the conscious engagement and retraining of the deep cervical flexor muscles [15]. This mechanism is similar to the mirror neuron system model proposed by Ramachandran and Altschuler [16] which suggest that visual feedback would improve the sensorimotor integration and facilitate cortical reorganization. Further support comes from research on cervical stabilization exercises when feedback is added that significant improvements in craniovertebral angle and proprioceptive control have been reported that this feedback assisted training optimizes the head-neck alignment and motor precision [17]. Falla et al. [18] and Jull et al. [19] have also reported that motor-relearning of the deep neck flexors with feedback-based methods enhances muscle endurance and postural stability, which is similar to the increased muscle endurance that was observed in the mirror feedback group.

Mirror assisted training enhances activation of the deep cervical flexors which creates segmental stability of the cervical spine to prevent overloading the superficial neck and shoulder muscles and the resulting fatigue associated with pain. This is consistent with the motor control rehabilitation principles of JY Kim et al. [20] which emphasize the need for specifically prescribed exercises which are proprioceptively guided to restore the function of postural muscles. In contrast, the home-based group improved but not significantly so, a result that was similar to other studies that found that movement programmes performed at home, without supervision, resulted in measurable reductions in neck pain, although it was only to a certain extent, because of inconsistencies in adherence to the programmes and suboptimal movement quality [21].

Muscle endurance improved in the observed mirror feedback group (by 3.47 seconds on average), indicating better activation efficiency and fatigue resistance of the deep stabilizing muscles. This is consistent with those previously reported by Dusunceli et al. [22] that patients with chronic neck pain improving their endurance through cervical stabilisation exercises, and reducing pain, had significant improvements. Additionally, Bronfort et al. [23] have demonstrated that specific supervised exercise programs are more effective at decreasing neck pain and disability compared with passive treatments and medications, further emphasizing the usefulness of structured, supervised programmes such as the mirror feedback programme employed here.

As seen from a biomechanical point of view, the neck is often bent too far forward, the shoulders are raised too high, and uneven loads are applied to the neck during client treatment for longer periods of time by salon professionals [24]. Not only do stabilization exercises with mirror feedback enhance activation of deep muscle, but they also help to maintain optimal head-neck alignment which decreases the mechanical load on the cervical segments and prevents superficial postural muscles from becoming strained [25]. Enhanced deep neck flexor endurance prevents fatigue and can help decrease the likelihood of having recurrent pain episodes, particularly occupations that involve prolonged and repetitive postures [26].

In general, the present results support the efficacy of supervised stabilization exercises with mirror feedback and structured home-based exercise programmes for chronic neck pain in Salon professionals. Adding mirror feedback, however, greatly improved the degree of improvement in cervical muscle endurance, and had a modest additional effect on size of the functional improvement, highlighting the need for the incorporation of visual feedback mechanisms into physiotherapy interventions to maximise the control of the neuromuscular system, compliance and working ability and/or capacity of individuals who are exposed to repetitive and sustained working postures.

The mean improvement in the Intervention group (8.6 points) was not statistically different than that of the Control group (7.74 points) (Table 2) between groups. However, the improvement in cervical muscle endurance between the intervention and control groups was statistically significant in favor of the intervention group ($p=0.002$; ES: $r=0.35$) (Table 2).

LIMITATIONS

There are a number of limitations to this study. First, the sample size was small ($n = 30$), which is a limitation in terms of statistical power and generalizability. Secondly, the purposive sampling was used and the participants were selected from beauty salons of the Maval region, which reduced the representativeness of the broader population of beauty salon workers. Third, the length of the intervention was short (only 4 weeks) and the long-term sustainability of the improvements seen was not assessed. Fourth, the study examined only female salon professionals between the ages of 20–40 years, limiting the generalizability of the results to male salon professionals and other ages. Lastly, outcomes were evaluated primarily with the Neck Disability Index and Pressure Biofeedback Unit, and other objective measures for cervical muscle activation, posture and functional performance may have offered a more comprehensive assessment of the effects of the treatment.

CONCLUSION

Cervical stabilization exercises with mirror feedback and structured home-based exercise programmes were effective in both reducing pain and disability among

chronic neck pain Salon professionals. While the exercises were convenient, that is, were done at home, and were accessible to the participants, and were supportive of self-management, the exercises using the mirrors were more effective at increasing cervical muscle endurance, which may have been related to more accurate movement and better activation of the deep flexors of the cervical spine. These findings indicate the need to introduce mirror feedback into physiotherapy interventions to enhance the neuromuscular control system and enhance occupational outcomes, and supervised mirror-based stabilization combined with home-based exercises might be a useful intervention to treat chronic neck pain in salon workers who are repetitively and chronically in a postural demand.

Ethical Approval: The Ethical Clearance/Institutional Ethics Committee (IEC) approval number is (EC/NEW/INST/2019/377/294).

Declaration of Patient Consent: Patient consent was obtained before commencement of the study.

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AUTHOR CONTRIBUTIONS

Supriya Patil: Conceptualization, methodology, investigation, data collection, intervention, data analysis, and drafting of the manuscript.

Shyamli Kulkarni: Conceptualization, methodology, supervision, interpretation of results, critical revision of the manuscript, and final approval of the version to be published.

ABBREVIATIONS USED IN THE STUDY

NDI: Neck Disability Index

SPSS: Statistical Package for the Social Sciences

SD: Standard Deviation

PBU: Pressure Biofeedback Unit

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