Original Article

Effect of MaRhyThe versus Myofascial Mobility Tool in Female individuals with or without Neck Pain Having Forward Head Posture and Buffalo Hump – A Randomized Clinical Trial

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Abstract

Background and Objectives: Prolonged forward head posture (FHP) leads to the development of buffalo hump (BH) at the base of the posterior neck, predominantly seen in females. MaRhyThe (MRT) and myofascial mobility tool (M_2T) are novel physiotherapy methods applied in various soft-tissue disorders. A dearth of literature exists about using these methods for the treatment of BH and FHP. Hence, the aim of the present study was to compare the effects of MRT and M_2T in female individuals having FHP and BH.

Materials and Methods: The study was a randomized clinical trial. Twenty female were randomly allocated to Group A ($n = 10$) and Group B ($n = 10$) who received MRT and M_2T, respectively. The primary outcomes assessed included craniovertebral angle (CVA), neck circumference (NC), and skinfold measure. The secondary outcomes were cervical endurance and range of motion that were assessed on day 1 (pre) and day 10 (post). Exercise and study intervention (MRT/M_2T) were given alternately for 10 days.

Results: All the primary and secondary outcome parameters analyzed at days 1 and 10 showed statistically significant results for both the study groups ($P < 0.001$). However, analysis between the two study groups showed no statistically significant difference for Northwick Park Neck Pain Questionnaire ($P = 0.08$), NC ($P = 0.56$), and skinfold measure ($P = 0.72$) except for CVA ($P = 0.03$).

Conclusion: Both MRT and M_2T interventions were effective in reducing the BH and correction of FHP in addition to improving cervical mobility and endurance. However, MRT proved to be superior to M_2T in terms of correction of FHP and reduction of the BH.

Keywords: Buffalo hump, Forward head posture, MaRhyThe, Myofascial mobility tool

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INTRODUCTION

The latest working habits adopted in our daily life such as use of computers and gadgets by spending long hours gazing at versatile screens or even activities of leisure like slouching on a couch in front of the television, reading books, and driving have led to an alteration of regular mechanics of the body.[1] Literature states that abnormal biomechanics poses risks for various musculoskeletal problems such as neck pain (NP) and back pain.[2]

One of the most common nonideal postures known to cause these negative effects is the forward head posture (FHP),[3] with an estimated prevalence of 60%–90%,[4] which is a growing concern among the present generation.[5] It is known as a faulty habitual posture alignment of the cervical spine, wherein the head is positioned anterior to the shoulder.[4] This is accompanied by weakness of the deep cervical flexors and shortening of the antagonist group of muscles around the cervical spine.[6-9] The combination of these abnormal forces and stresses has led to an increase in lordosis of the cervical spine, described as an extended middle cervical spine and flexed lower cervical spine.[6-8] Literature states that those with FHP have decreased neck range of motion (ROM), craniocervical flexion range, and deep cervical flexor activation, with increased activation of the superficial muscles (sternocleidomastoid and anterior scalene).[7] The malalignment of the FHP has demonstrated to be associated with a decrease in craniovertebral angle (CVA)[7] which is a reliable measure for FHP.[5]

Prolonged FHP leads to stimulation of protective mechanism by the body in order to prevent further cervical spine deformation by the development of a buffalo hump (BH) at the base of the neck posteriorly.[9] According to available literature, it is described as a subcutaneous fat deposition in excess at the cervical–thoracic junction (C6–T4).[10] While few studies state the hump as a protective mechanism,[9,11] other studies say that the BH also is associated with demerits such as headaches, unstable blood pressures, restriction of cervical mobility, loss of feeling in fingers, degeneration, and dystrophic changes of surrounding soft tissue which contribute to the development of the hump, i.e., the adipose tissue. As females are more prevalent to develop the BH,[1] they consider it disapproving and depressing for their body image.[10] BH is present in other metabolic disorders such as Cushing's syndrome,[12] obesity, fatty liver, insulin resistance[13] and as a side effect to antiretroviral therapy[14]

MaRhyThe (MRT) and myofascial mobility tool (M_2T) are novel noninvasive physiotherapy treatment methods, which are gaining fame for their outcomes in various soft-tissue disorders[15] such as pain reduction, increasing ROM, and relieving muscle tightness, adhesions, and improving scar tissue mobility.[15-20] M_2T is an IASTM tool, which has 8 treatment sides which are used to treat various areas ranging from large to small.[16-18] MRT is a vibromassage tool[21,22] that aims to stimulate the normal physiological vibrations of the musculoskeletal and nervous systems of the body/tissue[23] by producing oscillations through a probe which is said to be equal to that of the vibrations produced within a normal tissue, i.e., 8–12 Hz.[24]

A dearth of literature exists using these novel tools for body contouring or treatment of regional body fat and FHP. Hence, the aim of the present study was to compare the effects of MRT and M_2T on BH size, FHP, and cervical ROM in female individuals with or without neck pain having FHP and BH.

MATERIALS AND METHODS

Ethical clearance was obtained from the Institutional Ethical Committee (KIPT/SI No. 180/14.05.2018) and registered in the Clinical Trial Registry–India under the registration no. CTRI/2018/07/014922. The study was a randomized clinical trial. The study was conducted between March 2018 and February 2019. The estimated total sample size was 18 based on the mean BH prevalence in an earlier study[13] conducted by the same authors. To compensate for any dropouts, 20 was taken as the sample size (α = 5% and β = 80%).

One-hundred and twenty-four (n = 124) individuals were screened for eligibility. Twenty (n = 20) individuals were enrolled in the study. A closed envelope technique was used to randomly allocate the individuals into the two study groups, namely Group A: MRT and conventional physiotherapy (n = 10) and Group B: M_2T and conventional physiotherapy (n = 10). Written consent was then taken from all participants, and details about the study were briefed in their vernacular languages. Brief demographic data of the age, height, weight, and body mass index (BMI) were taken.

Individuals were selected based on the inclusion criteria which were: (1) females between the age groups of 18 and 25 years, (2) CVA between 37 and 57 degrees, (3) a visible protuberance in the suprascapular region more than 10 mm, (4) with or without neck pain, and (5) volunteering to participate in the study. Individuals were excluded as per

the exclusion criteria, i.e., (1) clinical features of spinal cord compression, (2) history of tumors and infection of the vertebrae, (3) any recent surgeries of the cervical and thoracic spine within the past 6 months, (4) severe psychiatric illness and neurological or cognitive impairment, (5) vestibular disorders, traction anxiety, and cardiovascular diseases, (6) cannot tolerate supine/prone lying position, and (7) pregnant women [Figure 1].

The primary outcomes were CVA, Northwick Park Pain Questionnaire (NPQ), neck circumference (NC), and skinfold measure. A photographic method was used for measuring CVA, where the participant was in standing position with the camera placed 2 m away, C7, and the acromion process was marked with a pen. A line was then drawn through the tragus of the ear and C7, and the angle formed between was measured with a protractor.[5-7] For NPQ, the study participant was asked to mark his pain based on the severity. It has a total of 10 sections which are scored from 0 to 4 points each answer (0 – no significant pain and 4 – significant for worst pain).[25] The NC was measured with a measuring tape midway between the neck, i.e., the mid-cervical spine, and the mid-anterior neck to within 1 mm.[26] Skinfold of the BH region was taken with a caliper, and a total of 3 readings were taken with 4 s rest between each reading.[27] An average of 3 readings was considered for analysis [Figure 2].

The secondary outcome measures assessed in the present study were cervical ROM and neck FE test. The cervical ROM was assessed using a digital inclinometer that was placed posteriorly with one end on the C7 spinous process and the second on the posterior aspect of the head. The participant was then instructed to bend the head down without slouching for flexion and back for extension. The reading was then calculated by 1st minus the 2nd reading.[28] For cervical flexion endurance testing, participants were asked to perform craniocervical flexion and maintain it for 10 s each hold at 5 different levels from 20 to 30 mmHg through feedback given by a handheld dial with a 2 mmHg increase after 30 s rest.[8] The activation score was used for assessment. All outcomes were assessed on day 1 (pre) and day 10 (post) of the intervention.

Both study interventions (MRT/M_2T) were given with the participant lying prone on the couch with a pillow under their chest and the head flexed forward, while the therapist stood at the head end of the patient. In MRT, the upper back was divided into 3 major areas, i.e., posterior aspect of the neck, the trapezius upper, and middle back, and treated as a whole. The frequency of vibration was kept between 8 and 12 Hz depending on the depth required for treatment in each area. The direction of draining the lymphatic fluid was into the cervical, axillary, and thoracic lymph nodes on both sides starting from the center of the hump [Figure 3].

M_2T treatment for the upper back was divided into 5 areas which included suboccipital area (posterior aspect of the neck), upper trapezius, suprascapular, infrascapular area, and medial aspect of the scapula. The center of the spine from neck to upper thorax was also treated. Each area was treated with 2 sets of 1 min per part with rest time of 1 min.[20] The direction of draining of lymphatic fluid was into the cervical, axillary, and thoracic lymph nodes bilaterally starting from the center of the hump [Figure 4]. All the participants received a total of 30 min of MRT[29] in

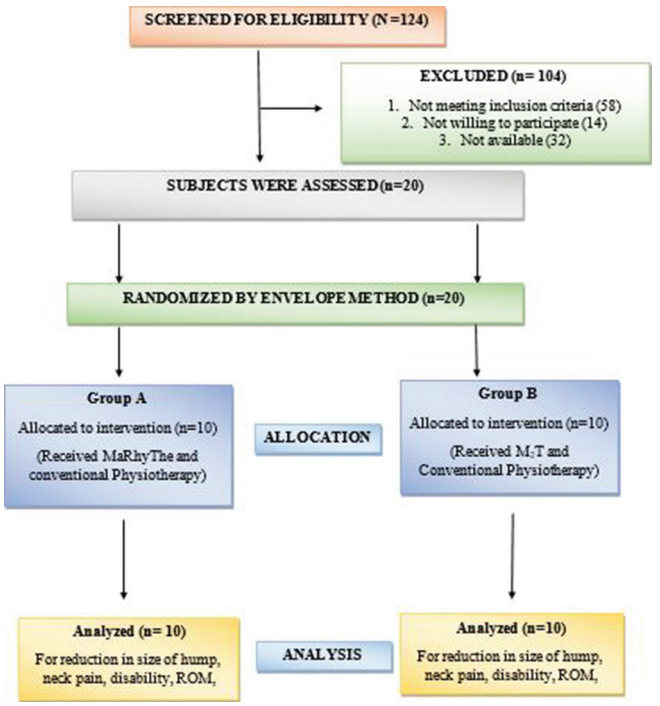

Figure 1: CONSORT flow diagram

Figure 2: Skinfold measure of the buffalo hump with the caliper

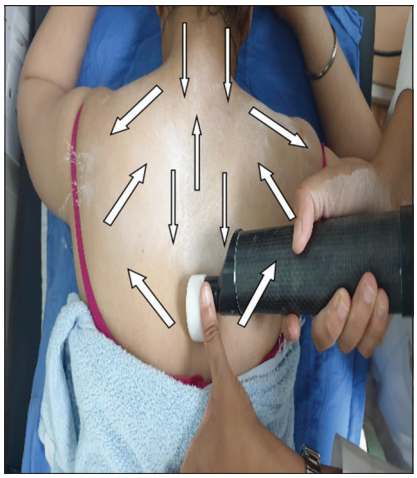

Figure 3: MaRhyThe for buffalo hump

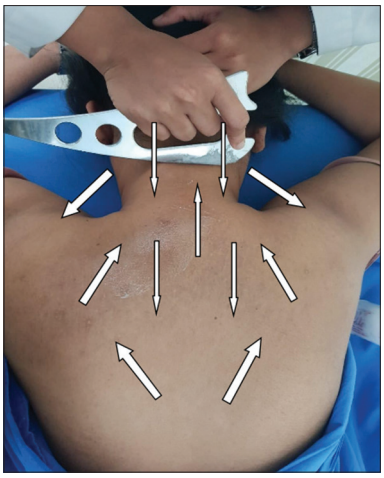

Figure 4: Myofascial tool application for buffalo hump

Group A and 30 min of M_2T[20] in Group B, with 5 alternate day sessions over a period of 10 days.

Both the groups received 5 sessions of conventional physiotherapy which was given alternatively on the days when MRT and M_2T were not given over a period of 10 days which lasted for 30 min. The intervention included 4 min of suboccipital release,[6] 3 repetitions of manual cervical traction using a belt (hold for 10 s, 10 s of rest period).[30] It also included stretching of the cervical extensors in supine, stretching of bilateral pectorals and upper trapezius muscle fibers in sitting with back supported (15 s hold, 3 sets of each stretch)[31-34] and neck isometric exercises for the neck flexors, extensors and lateral flexors (15 s hold, 5 sets of each)[35,36] [Figure 5].

The study was analyzed using the SPSS version 22.0 (SPSS for windows, Armonk, NY: IBM corp., USA). The distribution of the quantitative parameters was checked using Kolmogorov–Smirnov test, which showed that there was a normal distribution. The parameters were analyzed using the independent *t*-test for within-group differences. The between group analysis was performed using one-way analysis of variance.

RESULTS

The mean age and BMI of the participants in Group A was 21.70 ± 0.67 years and 26.35 ± 3.24 kg/m^2, and in Group B, it was 22.40 ± 0.84 years and 25.95 ± 4.00 kg/m^2, respectively [Table 1], which showed to be homogeneous.

A significant improvement was noted within the group for CVA in Group A ($P = 0.0001$) with 8.53% change and that of Group B ($P = 0.0001$) with 5.81% of change. Statistical significance was also noted in terms of CVA, with Group A being superior to Group B ($P = 0.03$) [Table 2]. Both Group A ($P = 0.03$) and Group B ($P = 0.002$) showed a statistically significant difference from day 1 to day 10 for reduction of NPQ scores for neck pain. However, between-group analysis ($P = 0.0885$) showed no statistical significance [Table 2].

Within-group comparison of Group A (MRT) showed a significant reduction in BH size which was interpreted from NC ($P = 0.0001$, 3.93%) and skinfold measure ($P \leq 0.0001$, 77.12%). Group B (M_2T) also demonstrated significant changes within the group for reduction in BH size with NC ($P = 0.005$) and skinfold measure ($P < 0.0001$), with the percentage of change being 3.38% and 69.22%, respectively. However, between the groups, there was no statistical significance seen for NC ($P = 0.56$) and skinfold measure ($P = 0.72$) [Table 3].

In terms of cervical endurance/strength test, both Group A ($P = 0.0002$) and Group B ($P = 0.009$) showed a significant improvement when compared before and after intervention. The between-group comparison showed no statistical significance ($P = 0.13$) [Table 4]. Similarly, for cervical ROM, Group A showed a significant improvement for cervical flexion ($P = 0.01$) as well as extension ($P = 0.01$). Group B also demonstrated a significant increase in ROM of flexion ($P = 0.003$) and extension ($P = 0.01$). Between-group comparison was not significant statistically for both flexion ($P = 0.85$) and extension ($P = 0.45$) ROM of the neck [Table 4].

The parameters analyzed at days 1 and 10 showed to be statistically significant within both the study groups, with no statistical significance between the groups except for that of CVA. The interventions showed not only statistical significance within the groups but also clinical significance

in correction of the FHP in terms of improvement in CVA ranging between 5% and 6% in both the study groups along with reduction in the BH (NC and skinfold measure) by 40%–50% [Figures 6 and 7].

DISCUSSION

According to the author's knowledge, this study is the first of its kind, in which a noninvasive treatment protocol has been formulated for the treatment of the BH.

Figure 5: Conventional Conventional Physiotherapy

Figure 6: Pre–post difference with myofascial mobility tool treatment on buffalo hump

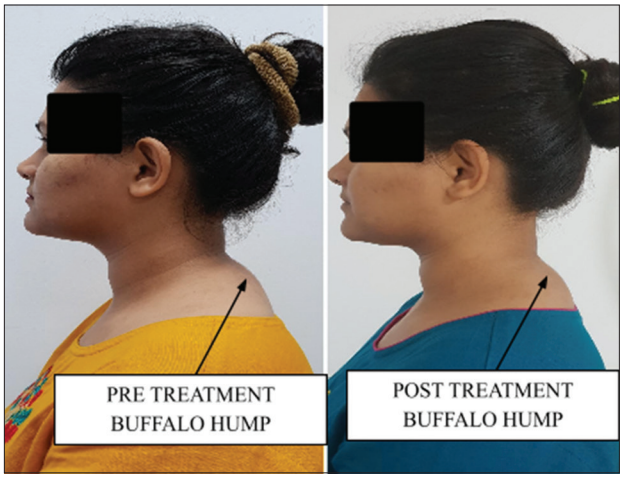

Figure 7: Pre–post difference with MaRhyThe on buffalo hump

According to Tolkachov, to treat the hump effectively, the alignment of the spine should be the level 1 approach, as the hump causes a restriction in mobility of the cervical spine, so if the vertebrae mobility is increased, then the fat is said to be easily mobilized,[10] which was one of the aims of the study. Studies on MRT combined with conventional physiotherapy have shown to be effective in the treatment of frozen shoulder by showing improvement in pain, disability, and ROM when comparing MRT versus stretching.[23] The duration of MRT in the present study was in accordance to another study where the effects of MRT versus massage were assessed on lower-limb circulation, concluded that MRT was more superior to massage causing more prominent increase in the parameter of blood flow tested in the study.[29] A study by Angelika Spitz, wherein MRT was used for correction of scoliosis with other therapies such as mobilization, counseling, and hypnotherapy for 3 months, resulted in effective correction of the curve and mobility of the spine along with improvement seen in sleep and emotional stability.[37]

The reason for the MRT therapy to be effective could be based on the theory mentioned by Dr. U.G. Randoll that it produces oscillation that is similar to that of normal cellular vibration of 8–12 Hz, which improves the oxygen supply to the cells, therefore re-establishing its nutrition supply through enhancement of the microcirculation. This results in relaxation of soft-tissue structures, minimizing pain that indirectly contributes to increased mobility and tone of the tissues.[24] Improvement in tone and mobility of paracervical muscles might put the spine in proper alignment resulting in better reduced FHP, indirectly having effect on regional fat.[10]

In the present study, MRT showed to be clinically and statistically effective in reduction of hump size. The reduction in hump size can be supported by various studies that state that abnormality in the lymphatic system leads to leakage and stasis of lymph and, if not drained early, can become chronic and undergo various physiological changes and converts to fat and accumulate as subcutaneous fat below the skin.[38] A previously conducted similar study has shown MRT to be effective in reduction of lymphedema and has a good long-term effect as well.[22] In another study, it showed that it helped reducing post mastectomy-induced lymphadenopathy in a female with restriction and pain in the shoulder joint using MRT in combination with other physiotherapy treatments such as exercises, joint mobilization, and compression therapy.[39]

M_2T along with the conventional physiotherapy which was given in the same time frame as that of MRT, i.e., 30 min,[20,29] also proved to be clinically and statistically significant improvement in CVA scores for FHP and reduced hump size. A study done using M_2T alone has shown to be effective in reducing pain and improving shoulder mobility in recreational athletes as compared to Kinesio taping method.[17] In another study, it was also effective in treating trapezitis after only 1 session with significant changes in the VAS score post treatment.[18] However, not many studies using M_2T in combination with regular physiotherapy treatment are available. Hence, the present study is the first to use it in combination with other conventional physiotherapy treatments. The mechanism of pain relief is based on the principle of mechanotherapy. It is described as a form of therapy that uses mechanical stimulus to cause biological effects through a mechanotransductive pathway which is responsible for the conversion of the external stimulus provided by the tool or any soft-tissue mobilization therapy into a biological response within the cell in the form of regeneration, repair, and healing.[40] This promotes breakdown of adhesions within fascia and scar repair,[20] leading to improvement in function.[40]

This therapy has also shown to be effective for the reduction of the BH. However, there is a dearth of literature available in support for the same. A review on

Table 1: Demographic distribution of parameters in the two study groups (*n*=20)

Variable	Groups	Mean±SD	*t*	*P*
Age (years)	Group A	21.70±0.67	−2.0494	0.0553
	Group B	22.40±0.84		
Height (cm)	Group A	156.10±4.79	0.0397	0.9688
	Group B	156.00±6.36		
Weight (kg)	Group A	63.63±9.98	0.2051	0.8398
	Group B	62.83±7.25		
BMI (kg/m^2)	Group A	26.35±3.42	0.2404	0.8128
	Group B	25.95±4.00		

#Using independent *t*-test; Group A: MRT, Group B: M_2T. MRT: MaRhyThe, M_2T: Myofascial mobility tool, BMI: Body mass index, SD: Standard deviation

Table 2: Comparison of the craniovertebral angle and pain intensity within and between the intervention groups (*n*=20)

Groups	Craniovertebral angle			NPQ (%)		
	Pretest	Posttest	Difference	Pretest	Posttest	Difference
Group A	38.60±4.62	42.20±4.92	3.60±1.07	7.03±9.05	0.00	7.03±9.05
Group B	43.80±4.64	46.50±4.77	2.70±0.67	15.46±11.72	0.00	15.46±11.72
Percentage of change in Group A			8.53%#, *P*=0.0001*			100.00%#, *P*=0.0363*
Percentage of change in Group B			5.81%#, *P*=0.0001*			100.00%#, *P*=0.0024*
t	−1.9856	−2.5109	2.2422	−1.8009		−1.8009
P	0.0625	0.0218	0.0378	0.0885		0.0885

#Using independent *t*-test; *$P<0.05$ indicates significant. NPQ: Northwick Park Neck Pain Questionnaire, Group A: MRT, Group B: M_2T, MRT: MaRhyThe, M_2T: Myofascial mobility tool

Table 3: Comparison of pre- and postneck circumference scores within each intervention group (*n*=20)

Groups	Neck circumference			Skinfold measure		
	Pretest	Posttest	Difference	Pretest	Posttest	Difference
Group A	33.10±2.74	31.80±2.53	1.30±0.54	26.92±6.76	6.16±6.46	20.76±8.23
Group B	33.75±1.14	32.61±1.07	1.14±0.68	28.36±6.11	8.73±6.41	19.63±5.46
Percentage of change in Group A			3.93%#, *P*=0.0001*			77.12%#, *P*=0.0001*
Percentage of change in Group B			3.38%#, *P*=0.0005*			69.22%#, *P*=0.0001*
t	−0.6937	−0.9325	0.5828	−0.4997	−0.8929	0.3619
P	0.4967	0.3634	0.5673	0.6233	0.3837	0.7217

#Using dependent *t*-test; *$P<0.05$; Group A: MRT; Group B: M_2T. MRT: MaRhyThe, M_2T: Myofascial mobility tool

Table 4: Comparison of pre- and postneck flexor endurance scores, cervical flexion, and extension range of motion within each intervention group (*n*=20)

Groups	Neck flexor endurance scores			Cervical flexion ROM			Cervical extension ROM		
	Pretest	Posttest	Difference	Pretest	Posttest	Difference	Pretest	Posttest	Difference
Group A	22.50±3.10	28.40±2.27	5.90±3.14	47.18±13.97	58.90±12.42	11.72±12.90	36.88±20.21	48.80±14.19	11.92±13.27
Group B	22.20±3.16	25.80±2.90	3.60±3.47	41.15±17.63	53.80±12.19	12.65±10.04	31.80±18.77	49.00±15.79	17.20±17.38
Percentage of change in Group A			26.22%#, *P*=0.0002*			24.84%#, *P*=0.0184*			32.32%#, *P*=0.0194*
Percentage of change in Group B			16.22%#, *P*=0.0095*			30.74%#, *P*=0.0032*			54.09%#, *P*=0.0121*
t	0.2145	2.2331	−1.5534	0.8477	0.9266	0.1798	0.5824	−0.0298	0.7637
P	0.8326	0.0385	0.1377	0.4078	0.3664	0.8593	0.5675	0.9766	0.4549

#Using dependent *t*-test; *$P<0.05$; Group A: MRT; Group B: M_2T. ROM: Range of motion, MRT: MaRhyThe, M_2T: Myofascial mobility tool

soft-tissue manipulation states that IASTM through the mechanotherapy principle can have a positive effect on the lymphatics by increasing the drainage of lymph and generation of new pathways that help to mobilize lymph, hence reducing pain and pressure on surrounding tissue by removal of waste products by increasing blood flow into the area.[40] Lymph is said to be closely related to subcutaneous fat[38] which is accumulated in the BH. This could be the possible mechanism for the reduction of the BH with M_2T.

The present study also demonstrated an equal improvement in the secondary outcomes that included cervical endurance and ROM in both the groups. This may be attributed to conventional physiotherapy which was a common treatment to both the groups. This included suboccipital release, stretching and strengthening of neck muscles, and cervical traction with chin tucks which, according to many previous studies, are useful in the treatment of FHP, NP as well as spinal alignment.[6,31,36] The short-term improvement in the neck activation scores and ROM is supported by statements in literature that stretching and strengthening can cause changes within a muscle in a period of 5 days if followed by scheduled exercises, causing changes in length–tension relationship as well as fiber reorganization.[32]

This study is not exempted from limitations. The outcome measure used to analyze the pre–post effects of the BH did not provide an in-depth detail of the fat reduction. The tools used for treatment varied in diversity, as one being a vibratory tool powered by electricity and the other a manual used IASTM tool which involves therapist dexterity to provide the movement of the tool on the tissue. The long-term effect of the therapy was not monitored, and the intervention lasted for only 10 days. In the future, the individual effects of the therapies can be carried out using sophisticated outcomes like ultrasonography.

CONCLUSION

Both MRT and M_2T interventions were effective in reducing the BH and correction of FHP in addition to causing improvement in cervical mobility and endurance. However, MRT proved to be superior to M_2T in terms of correction of FHP. This suggests that with minimal side effects, these interventions can be used for correction of neck posture as an alternative over surgical and medical procedures.

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Conflicts of interest

There are no conflicts of interest.

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