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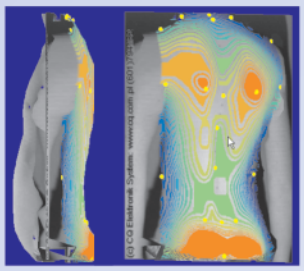

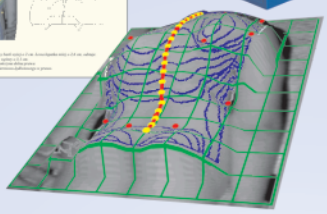

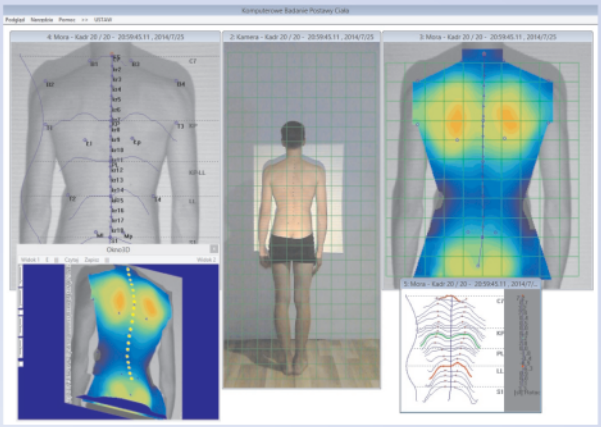

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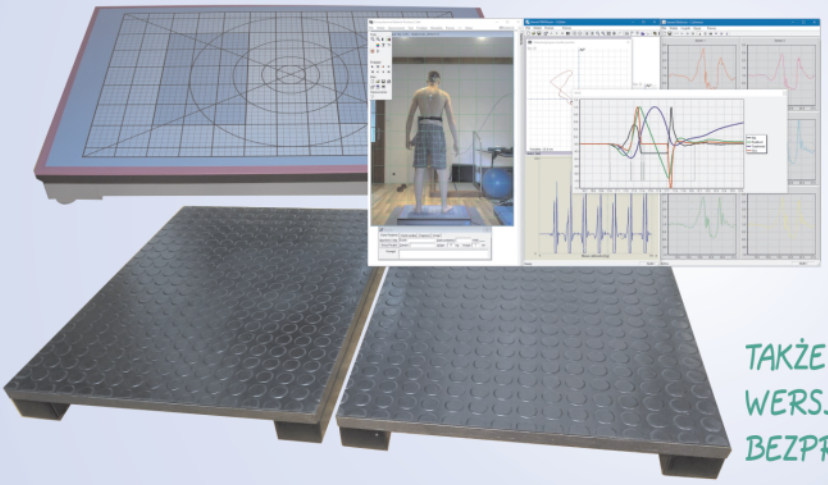

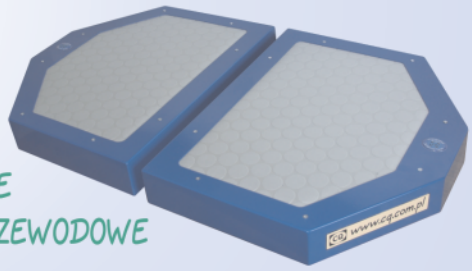

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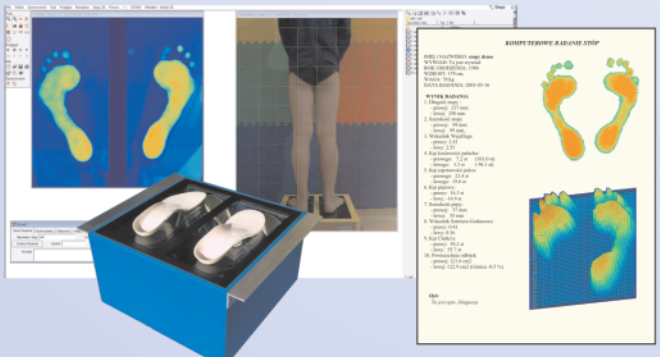

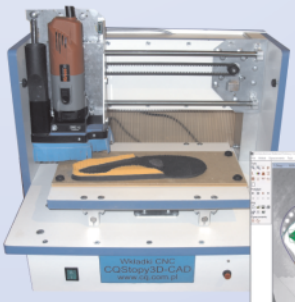

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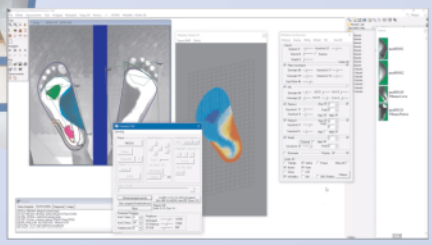

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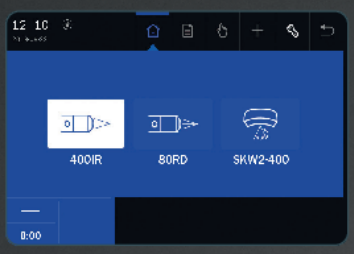

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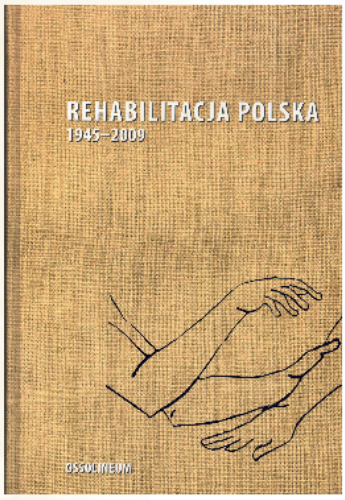

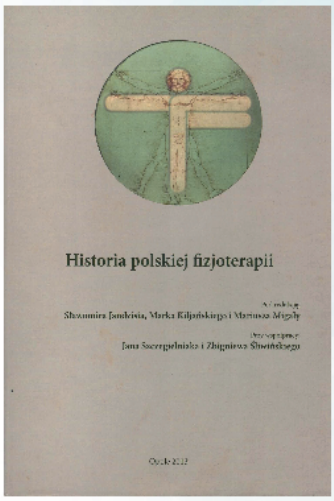

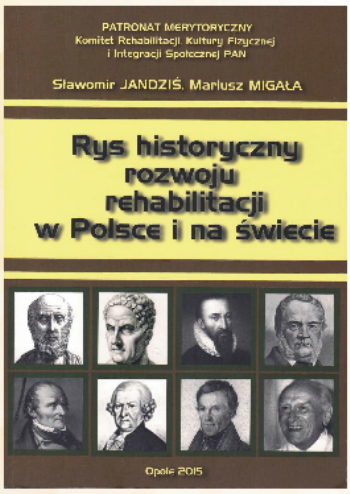

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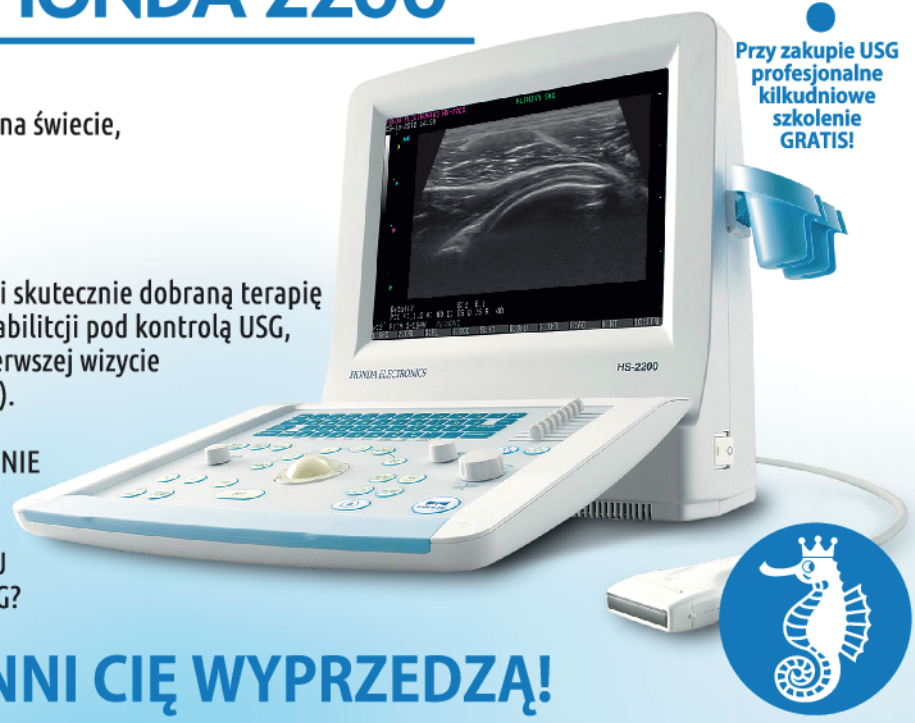

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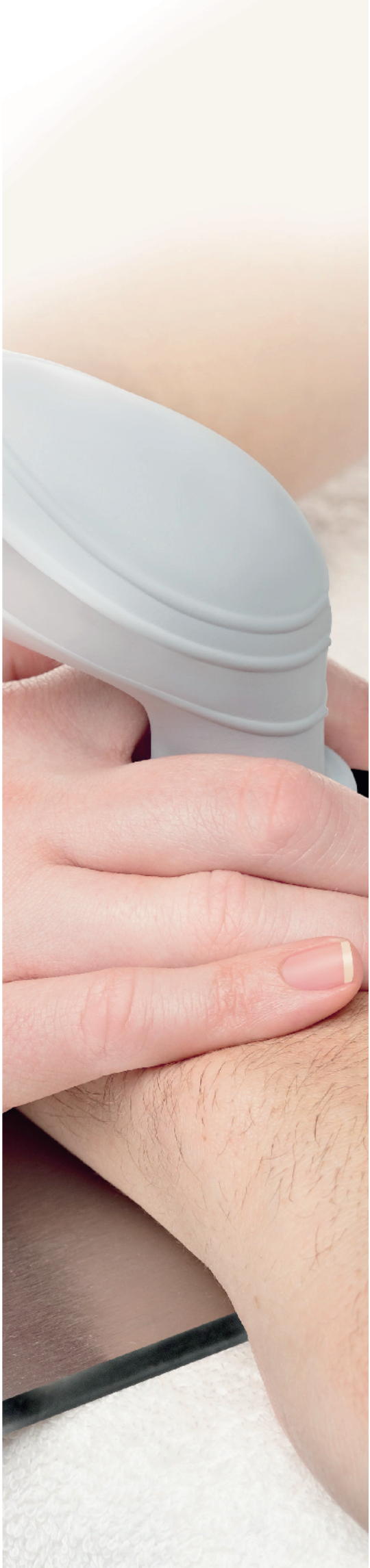

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Prone Versus Supine Traction in Treatment of Cervical Disc Bulge: A Randomized Controlled Trial

Naciąganie podczas leżenia na brzuchu a na plecach w leczeniu wypukliny krążka szyjnego: Randomizowane badanie kontrolowane

Ahmed Aboulfotouh Elsayed Abdallah[1(A,B,C,D,E,F)], Wadida Hassan Abdelkader[2(A,B,C,D,E)], Rania Nagy Karkousha[2(A,B,C,D,E)], Hatem M. El Azizi[3(A,B,C,D,E)]

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Abstract

Background. Disc bulge could lead to compression on adjacent nerve root causing neurological deficits. The purpose of this study is to compare between the effect of prone traction versus supine traction on the neck function and on the size of disc bulge in patients with cervical disc bulge.
Methods. Randomized controlled clinical trial design, 45 patients diagnosed with cervical disc bulge at C_5-C_6 and /or C_6-C_7 levels, their ages ranged from 40 to 50 years and were randomly distributed into three equal groups (A, B and C), the three groups received conventional physical therapy for cervical disc bulge, for (group B) traction from prone position was added and for (group C) traction from supine position was added. All participants received 3 sessions per week for one month. The assessment done before and after one month of treatment using neck disability index for neck function disability while size of disc bulge was assessed by using magnetic resonance image.
Results. A statistical significant decrease in the neck disability index scores of the three groups post treatment in comparison with that of pretreatment with high statistical significant decrease in the scores of group B and C post treatment in comparison with that of group A, while there was no statistical significant difference between group B and C in post treatment scores. There were no statistical significant differences between the post treatment measures in comparison with that of the pretreatment for the three groups regarding disc bulge size.
Conclusions. Adding cervical traction to the conventional physical therapy program for cervical disc bulge at C_{5-6} and /or C_{6-7} levels can yield more increase in the neck function compared with conventional physical therapy only, while the position of the patient during traction has no effect on the outcome measures.

Key words:

Traction, Cervical disc, Neck disability index

Streszczenie

Informacje wprowadzające. Wypuklina krążka może prowadzić do ucisku na sąsiednie korzenie nerwu, powodując ubytki neurologiczne. Celem tego badania jest porównanie wpływu naciągania podczas leżenia na brzuchu i na plecach na funkcję szyi i na wielkość wypukliny krążka u pacjentów z wypukliną krążka szyjnego. Metody. Projekt randomizowanego kontrolowanego badania klinicznego przeprowadzonego na 45 pacjentach, u których zdiagnozowano wypuklinę krążka szyjnego na poziomie C_5-C_6 i / lub C_6-C_7. Wiek uczestników wahał się od 40 do 50 lat. Zostali oni losowo podzieleni na trzy równe grupy (A, B i C), trzy grupy były poddawane konwencjonalnej fizjoterapii z powodu wypukliny krążka szyjnego, w przypadku grupy B dodatkowo wprowadzono naciąganie podczas leżenia w pozycji na brzuchu i w przypadku grupy C – w pozycji na plecach. Wszyscy uczestnicy byli poddawani 3 sesjom tygodniowo przez jeden miesiąc. Oceny dokonano przed i po miesięcznym leczeniu za pomocą wskaźnika niesprawności szyi dla upośledzenia funkcji szyi, natomiast wielkość wypukliny krążka oceniano za pomocą rezonansu magnetycznego.
Wyniki. Zauważono istotny statystycznie spadek wyników wskaźnika niepełnosprawności szyi w trzech grupach po leczeniu w porównaniu z wynikami przed leczeniem z wysokim statystycznie istotnym spadkiem wyników w grupie B i C po leczeniu w porównaniu z grupą A, przy braku statystycznie istotnej różnicy między grupą B i C w wynikach po leczeniu. Nie zaobserwowano statystycznie istotnych różnic między pomiarami po leczeniu w porównaniu z tymi przed leczeniem dla trzech grup pod względem wielkości wypukliny krążka szyjnego.
Wnioski. Wprowadzenie naciągania szyjnego do programu konwencjonalnej fizjoterapii przy wypuklinie krążka szyjnego na poziomie C_{5-6} i/lub C_{6-7} może spowodować poprawę funkcji szyi w porównaniu do samej fizjoterapii. Pozycja pacjenta podczas naciągania nie ma wpływu na wynik.

Słowa kluczowe:

Naciąganie, krążek szyjny, wskaźnik niepełnosprawności szyi

Introduction

Disc bulge occurs when the nucleus pulposus shifts from the center and protrudes within the annulus fibrosis. This process may be acute or chronic. Chronic bulge occurs with intervertebral disc degeneration as part of the natural aging process; this causes symptoms of gradual onset that tend to be less severe. While, acute bulge results from trauma, result in a sudden onset of more severe symptoms when compared to chronic bulge [1].

The prevalence of cervical disc bulge increases with aging for both men and women and is most frequent in people in their third to fifth decades of life. It is common in females, accounting for more than 60% of cases. For both gender, the most common patients with cervical disc bulge were in the age group of 51 to 60 [2].

The role of the intervertebral disc is to decrease the compressive stresses during activities. Disc lesions seem lead to mechanical compression or chemical disturbance of the nerve root causing neurological disorders [3]. Spinal traction is considered as a conservative treatment for different types of neck or back problems [4]. Different theories have been suggested for explaining the effects of traction, Spinal traction could increase the intervertebral space and stretch the posterior longitudinal ligament and this case might be related to the suction impact of the negative intra discal pressure and the pushing action of the posterior longitudinal ligament [5].

Cervical traction is ordinarily managed while the patients laying supine or in sitting position and the past trials associated with practical applications focused on the supine position [6]. Deets et al, [7] explained that the head weight during supine posture was cancelled, thereby supporting the effect of traction compared with that in the sitting position. There were previous studies about prone traction done on lumbar spine for patients with chronic low back pain and disc lesion which revealed that there was a significant decrease in pain and improvement in functional outcome for those patients [8, 9].

There is a gap in the area of cervical prone traction, Accordingly, this study was conducted to compare between the effect of prone traction with supine traction on cervical function disability and size of disc bulge in patients with cervical disc bulge at C5-6 and /or C6-7 levels.

Subjects and methods

Study Design

A prospective randomized controlled clinical trial to compare between the effect of prone traction with supine traction on the neck disability scores and the size of disc bulge in patients with cervical disc bulge. The study was performed between September 2017 and February 2019. The research related to human use has been approved by the authors institutional review board at the Faculty of Physical Therapy, Cairo University with a reference number P.T.REC/012/001588. It was registered in Pan African Clinical Trial Registry with the identification number: PACTR201703002102112.

Participants

Forty-five Participants of both genders with a diagnosis of chronic central cervical disc bulge at C_5-C_6 and/or C_6-C_7 levels diagnosed in magnetic resonance images (MRI) by the orthopedist or neurosurgeon, participants' ages ranged from 40 to 50 years and their body mass index ranged between 18.5 to 25 kg/m^2. They were recruited from the outpatient clinic of Kasr El- Eini Hospital, after signing consent form. Exclusion criteria include patients who undergo to any previous cervical spine operations, medical red flags, patient with herniated cervical disc, patients with central canal stenosis and contraindicated from prone position patients. The consent form has been recorded from all subjects involved in this study.

Randomization

The patients were divided randomly into three groups, (group A) control group, (group B) prone traction group and (group C) supine traction group, fifteen patients in each group by a blinded, independent research assistant who used a random cards generated automatically by a computer (figure 1).

Intervention

Group A received conventional physical therapy program for neck pain which include (Manual therapy as follow, (Stretching exercises for lateral flexor muscles of neck, Oscillatory postero-anterior gentle mobilization and range of motion exercises for neck), infrared heat therapy for neck area by using infrared device (PHILIPS,230-250V, 250W), and TENS for 30 minutes at the cervical paraspinal pain areas identified by the patient by using phyaction 787 made in Holland, 230 v / 300MA / 50-60 Hz) [10]. Group B received conventional physical therapy program in addition to prone traction for cervical spine by using modified mechanical traction device for cervical spine in the form of traction table fixed with the bed at the same height. The traction table contains a well-padded sliding part that can slide when the traction is applied.

The patient laying in prone position and relaxed his head on the well-padded sliding part of the traction table and by using head halter, weights, rope and poly system the traction was conducted. Group C received conventional physical therapy program in addition to supine traction for cervical spine with the same mechanical traction device, the subject instructed to lie supine with a special pad under his or her head. The traction force was adjusted at 7% of body weight for each patient with 24º angle of pull for 20 minutes. The treatment frequency was three sessions per week for four weeks.

Outcome measures

All measurements were done pre and post treatment by another assessor who was blinded about subject group allocation.

Neck disability level was assessed pre and post treatment period for each patient by using the Neck Disability Index (NDI) which involves 10 items, with 7 items for activities of daily living, 2 items for pain, and 1 item for concentration. The index has been converted and validated to numerous languages which include Arabic [11]. The Arabic form of the index was administered and all subjects completed it. All participants were informed to answer about each item in the index to assess the degree of disability, each item was scored out of 5 and the total score was out of 50 then the result was managed as a percentage by doubling the total score with the no disability response in 0 score and higher scores represent more disability [12].

Additionally, The size of the bulged disc was measured in Magnetic Resonance Imaging (MRI device Philips intera 1.5T) by a radiologist pre and post treatment period for all groups by measuring the extension of the disc material beyond the bony margin in sagittal images [13], the transverse distance of the disc which bulged out of the vertebral borders inside the spinal canal was measured in the MRI mid sagittal T2 weighted series by using Philips DICOM viewer 3.0 program by drawing a vertical line parallel to the vertebral edge, then measuring the size of the bulge by drawing another horizontal line from the first one to the most prominent posterior point of the disc in millimeter.

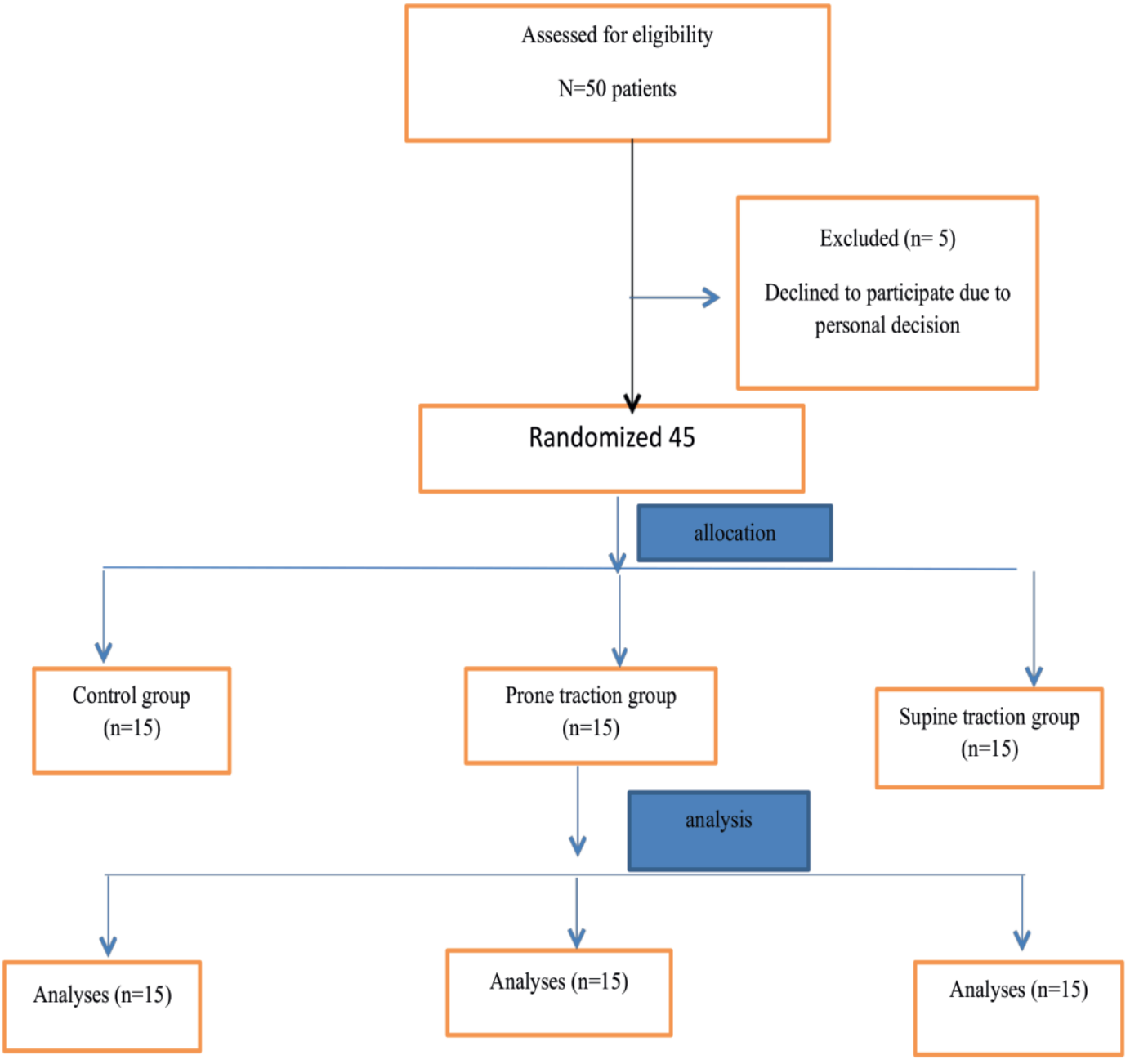

Figure 1. Flow chart of the study

Data analyses

The obtained data were analyzed by the Statistical Package for the Social Sciences (SPSS) software, version 25. Prior to analysis, data were assessed for normality, homogeneity, and occurrence of extreme scores. Descriptive statistics and ANOVA test was conducted for comparison of the subject characteristics between the three groups. Mixed MANOVA was conducted to compare the effect of treatment on mean values of NDI and size of the bulged disc. The level of significance for all statistical tests was set at $p < 0.05$.

Results

Comparing the general characteristics of the subjects among the three groups revealed that there were no statistical significant differences among groups in the mean age, weight, height and BMI ($p > 0.05$) (Table 1).

Mixed MANOVA was used to compare the effect of treatment on mean values of NDI and size of the bulged disc. Within group analysis, NDI scores it showed that there was a significant statistical reduction ($p < 0.05$) in post treatment scores compared with that of the pre treatment at the three groups. While in measurements of the size of the bulged disc there was a significant statistical reduction ($p < 0.05$) in post treatment scores compared with that of the pre treatment at group B only. Comparing the results among the three tested groups, it was revealed that there was a significant improvement ($p < 0.05$) in the post-testing mean values of NDI in the group (B) and group (C) compared with the group (A). There was no significant difference ($p > 0.05$) in the post-testing mean values of NDI between the two groups (B) and (C). As well as, there was no significant difference ($p > 0.05$) in the post-testing mean values of size of the bulged disc among three groups the (Table 2).

Table 1. Demographic data of participants

	Group A Mean ± SD	Group B Mean ± SD	Group C Mean ± SD	F-value	P-value
Age (years)	42.46 ± 3.46	43.06 ± 4	42.8 ± 3.93	0.09	0.91
Weight (kg)	68.53 ± 5.9	66.06 ± 5.5	65.8 ± 5.18	1.11	0.33
Height (cm)	169.8 ± 6.36	169.86 ± 5.39	170.8 ± 5.57	0.14	0.87
BMI (kg/m²)	22.91 ± 0.76	22.86 ± 0.76	22.52 ± 0.81	1.08	0.34

**Significant at alpha level < 0.05*

Table 2. Results of all dependent variables among the three tested groups

Dependent variables		Group (A) (n = 15)	Group (B) (n = 15)	Group (C) (n = 20)	Group A Vs. B p- value* (Cohen's d)	Group A Vs. C p- value* (Cohen's d)	`Group B Vs. C p- value* (Cohen's d)
NDI	Pre-treatment	25.2 ± 3.44	25.66 ± 3.19	25.06 ± 4.58	0.98NS(−0.46)	0.98NS(0.14)	0.98NS(−0.6)
	Post-treatment	8.46 ± 1.72	4 ± 1.36	4.2 ± 1.26	0.001S(4.46)	0.001S(4.26)	0.98NS(0.2)
	p- value** (Cohen's d)	0.001s (4.8)	0.001s(6.7)	0.001s(4.5)			
Disc Size	Pre-treatment	2.66 ± 0.41	2.67 ± 0.33	2.74 ± 0.38	0.98NS(−0.01)	0.98 NS(−0.08)	0.98NS(0.07)
	Post-treatment	2.65 ± 0.41	2.6 ± 0.34	2.72 ± 0.38	0.98NS(0.05)	0.98NS(−0.07)	0.98NS(0.12)
	p- value** (Cohen's d)	0.36 NS(0.02)	0.001NS(0.21)	0.07NS(0.05)			

** Inter-group comparison; ** intra-group comparison of the results pre- and post-treatment. Data expressed by mean ± SD, NS p > 0.05 = non-significant, S p < 0.05 = significant, p = Probability.*

Discussion

The aim of this study was to compare the effect of prone traction with supine traction on cervical disc bulge at C5-6 and/or C6-7 levels, the results showed that there was significant improvement in neck function in the three groups post treatment compared with that of pretreatment with more significant improvement in both study groups than the control group. While there were no significant differences between the study groups in post treatment scores. Regarding the size of disc bulge, the results showed that there were no significant differences in the measurements of the size of bulged disc post treatment for the three groups compared with that of the pretreatment. The current study has some points of strength as it covers a gap in the area of cervical prone traction while there were no previous studies conducted about this point, also using MRI in disc size measurements to compare between prone and supine traction is considered a point of strength in our study.

The intervertebral disc space was explained to diminish and causing the disc to degenerate when the time and degree of compressive loadings surpassed the physiologic tolerable limit [14, 15]. Reduction in the intervertebral disc space would narrow the intervertebral foramen effectively leading to impingement of the nerve root. A 1 mm reduction of the intervertebral disc space was found to cause a narrowing of 20–30% in the area of intervertebral foramin [15]. On the other hand, the prolonged traction could increase the intervertebral disc space and support the disc tissue recovery on biological and mechanical levels [16].

Cervical traction has frequently been utilized as a strategy of conservative management for cervical spine disorders. Cervical spine traction can aid by increasing the intervertebral foraminal space, diminishing intra-disc pressure, allowing movement of herniated disc material back into place, stretching paraspinal musculature and extending spinal curves [17].

The improvement in neck pain and function in the three groups may be returned to the possible therapeutic effects of various therapeutic modalities which used in the conventional program that was applied for the three groups. This agree with the study conducted by Diab and Moustafa, [18] that reported that there was improvement in pain level in patients with cervical spondylotic radiculopathy treated with conventional therapy.

Also, Matijevic-Mikelic et al., reported that in his study in which a group of patients with neck pain without the exclusion criteria for discogenic neck pain received cervical spine isometric exercises, TENS and therapeutic ultrasound, there were functioning improvement in some aspects such as concentration, reading, sleep, car driving, and work [19].

Mechanical traction effect may be considered as further explanation for the more significant improvement of the study groups compared with control group, this explanation is supported by Krause et al., [20] who reported that the increasing in the intervertebral foramen diameter by traction could lead to reduction in pain radiation and could neutralize neurological disorders by decreasing compression on the neural tissues in addition to increase the intervertebral spaces around foraminal areas and elongate the posterior ligament.

Moeti and Marchetti, [21] reported that in a previous study that was conducted to determine the clinical outcomes of cervical traction in patients with cervical radiculopathy, it was found that there was full resolution of pain in cervical radiculopathy patients treated with cervical traction, neck retraction exercises, scapular muscle strengthening, and mobilization/manipulation techniques.

In agreement, Joghataei et al., [22] found that traction for long duration could widen the intervertebral space and leading to disc tissue recovery.

Similarly, Lecocq's studies reported that cervical traction has different mechanisms of action, with a little widening in the intervertebral space, a decrease in intradiscal pressure and a possible suction effect for bulged disc. The tension in the posterior ligament can also push back the bulged disc [23].

Interestingly, there were previous studies conducted to investigate the structural changes in the spine during and post traction treatments, the computed topography study by Sari et al., was conducted to evaluate the spinal structure changes before and after 20 minutes of traction and it was found that there were changes in the spinal structure after traction in the form of regression in the area of disc herniation, widening in spinal area (11.21 mm2), elongation of cervical spinal column (1.39 mm) and intervertebral discal space widening at C5-C6 level [24]. MRI has been used to evaluate the effect of cervical traction on the herniated disc and showed significant reduction of the disc protrusion during traction in 72% of cases with a load of 13.6 kg (30 pounds) [25]. These previous studies investigated the structural changes of the spine during the traction time not after the treatment period as in our study.

There were no previous studies about prone traction for cervical spine, while there were studies about the effect of prone traction on lumbar spine by using the VAX-D, in his study Beattie et al., concluded that, Prone traction conducted with VAX-D for 16 to 24 visits was combined with significant improvements in pain intensity and Roland-Morris Disability Questionnaire (RMDQ) scores in both short- and long-term follow-up, in patients with activity-limited low back pain who had previously failed to nonoperative interventions for their current symptoms [26].

In another comparative study that compare between prone and supine traction but in lumbar spine the study revealed that, prone traction has some superiority on traditional supine traction at least in early stages after treatment with more improvements in pain intensity and Oswestry Disability Index scores at discharge [27].

The current study findings can explain that, cervical traction provides more improvements in function for patients with cervical disc bulge while it has no effect on the size of the disc bulge. These findings points toward directions of future studies with follow up strategy to assess the long There are some limitations of this study. Firstly, the lack of follow-up for several months' post rehabilitation program to evaluate the long lasting effect. Secondly, certain secondary outcome variables such as muscle strength were not assessed.

Conclusions

Adding of mechanical traction for cervical spine either from prone or supine position to the conventional physical therapy program yielded a significant improvement in neck function level while there is no difference in effect between traction from prone versus supine position on cervical disc bulge at C_{5-6} or C_{6-7} levels.

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