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Original Article

Pain Section

Effect of Deep Cervical Flexor Training vs. Conventional Isometric Training on Forward Head Posture, Pain, Neck Disability Index In Dentists Suffering from Chronic Neck Pain

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ABSTRACT

Neck pain accounts for 15% of all soft tissue problems seen in general practice and are a common reason for referral to physiotherapy treatment. The prevalence of neck pain in dentists is 74.3%. Musculoskeletal symptoms in dentists are caused due to many reasons for e.g., prolonged static posture, repetitive movements, suboptimal lighting, and genetic predisposition. Since deep cervical muscle activity is required in synergy with superficial muscle activity to stabilize the cervical segments, a study is needed, to compare the effectiveness of deep cervical flexor (DCF) training and posture correction training on neck pain and neck disability index and forward head posture.

Aim: To determine and compare the effect of DCF training on forward head posture, neck pain and neck disability index in dentists suffering from chronic non severe neck pain.

Material and Methods: Total of 30 subjects were selected, based on inclusion and exclusion criteria, who were further divided into Experimental and Control groups. Baseline information of dependent variables was taken at the beginning of study on day one, for Visual Analogue Scale (VAS) and Neck disability Index (NDI). Forward head posture was measured on day one using digital photograph technique. Then, Experimental group was given DCF training and Control group was given conventional isometrics training (CIT) for 4 weeks under supervision of examiner. All measurements were repeated at end of 4th week, on completion of study.

Results: It was observed that pain and disability had reduced in both groups on group analysis. But the forward head posture had improved significantly in experimental group only.

Conclusion: DCF training is more effective than CIT in improving forward head posture, decreasing pain and disability in dentists suffering from chronic neck pain.

Key words: Neck pain, Deep cervical flexor (DCF) training, Forward head posture, Dentist

INTRODUCTION

Neck pain (NP) is a common problem in the community, affecting approximately 70% of people at some point in their life [1]. In any one year, 30% of adults will report NP, and 5-10% will be disabled because of it. Although NP is usually regarded as self limiting and benign, it consumes a major proportion of healthcare resources. Musculoskeletal disorders (MSD) are a common cause of work-related disability among workers with substantial financial consequences caused by worker's compensation and medical expenses [2].

In comparison with any other health professionals, dental health workers report a higher incidence of work related MSD [3]. Chronic musculoskeletal (MS) pain appears early in dental career. By third year of their dental curriculum, more than 70% of dental students complain of pain [4]. Of all the bodily sites which show MS symptoms, the prevalence of pain in L4 – L5 region is found to be high, which is around 62%, whereas the prevalence of NP in dentists is 74.3% [5].

The NP symptoms in dentists are caused due to many reasons for e.g., prolonged static posture, repetitive movements, suboptimal lighting, and genetic predisposition. According to Ratzon, occurrence of Neck Pain in dentists is caused by frequent assumption of static postures, which usually requires more than 50% of the body's muscles to contract, to hold the body motionless while resisting gravity [6]. It is believed that repeated prolonged static postures initiate series of events that could lead to pain, injuries or career ending problems seen in MSD [5].

Deep cervical flexor (DCF) has a major postural function in supporting and straightening the cervical lordosis. It has been found that certain muscles in the cervical spine tend to weaken in NP, the most common of these being the DCF [7].

Indeed, evidence is emerging, that suggests that people with NP drift into a more forward head position (FHP) when they are distracted [8]. The main action of deep cervical flexor muscle which supports deep cervical flexor motion segments, is craniocervical flexion (CCF). Hence, DCF training is recommended clinically for the management of NP [9].

Moreover, retraining the DCF muscles, which has been shown to decrease neck symptoms and increase the activation of the deep cervical flexor muscles during performance of the clinical test of CCF, may improve the ability to maintain an upright posture of the cervical spine [9,1,8].

Conventional isometric training (CIT) aims at improving isometric function of neck muscle, which counteracts the forces of gravity in order to maintain head and neck in upright position [9,10]. It was found that peak isometric neck strength values were statistically reduced in subjects with chronic NP as compared to those in healthy controls in all the directions [10]. Keeping the above points in view, a study was undertaken, to determine and compare the effect of DCF training on FHP, VAS and neck disability index (NDI) with CIT on FHP, NP and NDI in dentists suffering from chronic not severe NP.

MATERIAL AND METHODS

This study was conducted for a duration of 6 months from Jan 2012 to June 2012 on dental surgeons working in Shri Bankey Bihari Dental College, Ghaziabad and Aggarwal Dharmarth Hospital, Shakti Nagar, Delhi, India. Out of total 52 dentist, 30 dentist aged 20-40 were selected, having chronic neck pain for more than 3 months and with neck disability index of less than 24 (mild to moderate disability) and palpable cervical joint tenderness, were selected. Those having

congenital or acquired postural deformities like kyphosis, scoliosis etc., spinal diseases like spinal cord compression, tumours, fractures, instability,inflammatory diseases, infections, neurological deficit or those who had undergone any neck surgery were excluded from the study. Informed consents were taken from all participants. Pre-test, Post-test experimental group design were used for study. The subjects were randomly divided into 2 groups of 15 subjects each:

Group A- Experimental group:Deep cervical flexion training.
Group B- Control group:Conventional isometrics training.

Instrumentation and Tools Used

- Canon digital camera (photo shot a590) with 4x optical zoom, 8.0 mega pixel.
- Pressure Stabilizer – the Pressure Biofeedback Unit (Stabilizer TM, Chattanooga Group, INC., Chattanooga, TN).
- Digitizing software (Image tool UTHCSA version 3.0 university of Texas health service center, San Antonio, TX).
- Adjustable camera stand.
- Plumb line.
- Anatomical markers.
- NDI and VAS scales.

Baseline information of dependent variables was taken at the beginning of study on day one. Before commencement of training protocol, a body discomfort chart was given to the dentists to mark the area(s) of pain/discomfort. Visual Analogue Scale (VAS) and Neck disability Index (NDI) were given to indicate the level of pain and functional disability. Forward head posture was measured on day one for each subject using digital photograph technique, which was considered as baseline measurement.

Then, experimental group was given DCF training and control group was given CIT for 4 weeks. Exercise regime was conducted over a 4 week period under supervision of an examiner. Subjects were asked not to receive any other specific intervention for NP. All measurements were repeated at end of 4thweek.

The baseline values for all dependent variables, namely, forward head posture, disability and pain intensity were recorded on day one and they were designated as FHP-0, NDI-0 and VAS-0 respectively. The final readings were recorded at the end of 4 weeks and they were designated as FHP-4, NDI-4 and VAS-4 respectively.The data was analyzed using SPSS 15 software. Paired t–test was applied for comparison of FHP, pain on VAS and disability on NDI within groups. Independent t-test was applied to compare FHP, disability on NDI and pain on VAS between the groups. The tests were applied at 95% CI and p-values of ≤ 0.05 were considered as statistically significant.

RESULTS

Thirty subjects including 12 females and 18 males participated in the study. Subjects had a mean age of 26±4.28years, ranging from 20-40 years.

Forward Head Posture (FHP)

Forward head posture was measured on day one prior to intervention (baseline data as FHP-0) and at end of study i.e. after 4 weeks (represented as FHP-4). [Table/Fig-1] shows group analysis. Paired t test was applied, which showed significant improvement in Group A (p =.000) but no significant improvement in Group B (p =0.164).

[Table/Fig-2] shows analysis between the groups, conducted using independent t-test. It was observed that the baseline readings of both the groups were statistically insignificant (p=.849), whereas final readings i.e., FHP-4 using independent t- test revealed significant differences between groups (p=0.)

Neck Disability Index (NDI)

Neck disability index was measured on day one prior to intervention (baseline data as NDI) and at end of study i.e. after 4 weeks (represented as NDI 4).

[Table/Fig-3] shows group analysis. Paired t–test was applied, which showed significant improvement in both Group A (p =.000) and Group B (p =.000).

[Table/Fig-4] shows analysis between the groups, done using independent t-test. It was observed that baseline readings for both the groups were statistically insignificant (p=.543).

The final readings, i.e., NDI 4 using independent t-test revealed significant differences between groups (p=0.000).

Visual Analogue Scale (VAS)

Pain intensity was measured on VAS scale on day one (baseline data as VAS 0) and at end of study i.e. after 4 weeks (represented as VAS 4).

[Table/Fig-5] shows group analysis, which showed that on comparing the values between the baseline i.e. VAS 0 and after 4 weeks (VAS 4), significant improvements were noted in both group A (p = 0.000) and group B (p= 0.000).

[Table/Fig-6] shows the readings on day 1 (VAS 0) between groups A and B; no significant difference was observed, (p=0.800), whereas comparison of the final readings i.e. VAS 4 using independent t-test revealed significant differences between groups (p=0.001).

	FHP0 degree Mean(±SD)	FHP 4 degrees Mean(±SD)	Paired t – test	
			t–value	p
Group A n=15	40.95 (±1.076)	41.83 (±1.002)	–8.259	0.000
Group B n=15	41.00 (±1.108)	41.05 (±1.060)	–1.468	0.164

[Table/Fig-1]: Comparison of FHP within the Groups

	Group A n=15	Group B n=15	Independent t–test	
			t	p
FHP 0 Degrees Mean (±SD)	40.95 (±1.076)	41.00 (±1.108)	-0.134	0.849
FHP 4 Degrees Mean (±SD)	41.83 (±1.002)	41.05 (±1.060)	2.053	0.049

[Table/Fig-2]: Comparison of FHP between the Groups

	NDI 0 Mean (±SD)	NDI 4 Mean (±SD)	Paired t-test	
			t–value	p
Group A n=15	17.20 (±1.207)	14.33 (±1.234)	13.315	0.000
Group B n=15	16.93 (±1.163)	16.33 (±1.047)	4.583	0.000

[Table/Fig-3]: Comparison of NDI within the Groups

	Group A n=15	Group B n=15	Independent t–test	
			t	p
NDI 0 Mean (±SD)	17.20 (±1.207)	16.93 (±1.163)	0.616	0.543
NDI 4 Mean (±SD)	14.33 (±1.234)	16.33 (±1.047)	-4.786	0.000

[Table/Fig-4]: Comparison of NDI between the Groups

	VAS 0 Mean(±SD)	VAS 4 Mean(±SD)	Paired t-test	
			t–value	p
Group A n=15	5.27(±0.704)	3.80(±0.676)	8.876	0.000
Group B n=15	5.33(±0.724)	4.73(±0.704)	4.583	0.000

[Table/Fig-5]: Comparison of VAS within the Groups

	Group A n=15	Group B n=15	Independent t–test	
			T	p
VAS 0 Mean(±SD)	5.27(±0.704)	5.33(±0.724)	-0.256	0.800
VAS 4 Mean(±SD)	3.80(±0.676)	4.73(±0.704)	-3.704	0.001

[Table/Fig-6]: Comparison of VAS between the Groups

DISCUSSION

It was found in our study, that pain and disability significantly reduced in both the groups (on within group analysis). However, forward head posture showed significant improvement in experimental group only. All the other dependant variables showed improvements significantly in experimental group on analysis between groups.

To the best of our knowledge, this is the first study in which DCF training was used in dentists with neck pain and FHP. Limitations have therefore been imposed due to lack of literature in this area, leading to a limited scope for direct comparison with other studies.

Dental surgeons suffer more frequently from work related MSDs as compared to other health professionals [3]. The reason might be that prolonged FHP increases stress on the non–contractile structures and on the posterior cervical structures, thereby causing NP, as was reported by Chris Ho Ting et al., [11].

According to Watson and Trott, another reason might be the painless, insidious nature of repetitive minor trauma, like sustained flexed posture of head and neck, that affects the length tension relationship of cervical musculature, which causes increase in flexion moment of the head [12].

CCF is the principal action of DCF muscles [1]. DCF training as a treatment for forward head posture, is based on rationale that DCF plays major postural function in supporting and straightening the cervical lordosis. The high endurance of deep cervical flexor muscle, as was identified during the functional task of sitting, showed improved ability in holding an upright posture of cervical spine [8] and retraining these muscles was shown to reduce the neck symptoms and improve the ability in maintaining an upright posture of the cervical spine [3,4]. Hence, DCF muscle training is recommended clinically for management of neck pain [1].

In our study, a significant reduction in the pain associated with neck movements and joint palpation was found, this was in contrast with the results found in a randomized controlled trial conducted by Jull et al, which showed that treatment did not change the photographic measure of CVA representing the FHP associated with cervicogenic headache [13].

Our results suggested that pain and disability decreased significantly on analysis within groups. G Jull et.al also concluded that all the treatments significantly reduced the pain and disability associated with it but that none changed the measure of FHP [13]. The reason for this might be that hypoalgesia is concurrent with sympathetic nervous system excitation, suggestive of systemic pain modulation effects [14].

Another reason might be that both treatment methods were likely to induce local afferent input into the system to modulate pain perception [13].

Our results were in agreement with those of a study conducted by Thomas T.W. Chiuetal on the efficacy of isometric exercise for patients with neck pain and it found that after intervention, there was significant improvement in disability, pain and isometric neck muscle strength in all directions [15].

On analysis between groups, DCF training appeared to be effective in reducing pain and disability. The reason might be that DCF training specifically involved upper cervical flexion action and that majority of subjects suffered from neck pain. Thus, DCF training might have directly influenced pain sensitive structures of upper cervical region more than conventional isometrics training [14].

O Leary S et al., suggested that in people with neck pain, there were underlying neuromuscular problems which may not be adequately addressed by conventional strength and high-load endurance retraining. There is evidence which has indicated that addressing these muscle control problems with use of specific exercise strategies, leads to reduction in neck pain and associated symptoms [16].

Also, the direct relationship of endurance and forward head posture confirms the need for specificity in terms of rehabilitation of chronic neck pain [12].

Clinical Significance

As dentists spend long hours while treating their patients on dental chair, good work practices established early in their career may decrease the likelihood of developing physical problems associated with prolonged flexed posture. Habits or work practices learnt at this early stage often continue into later years of life and they may have an impact on the reduction of pain and disability in later stages. Furthermore, education on correct body posture and correct ergonomic advices must also be followed and DCF training should also be encouraged in functional positions.

Future Research

To give our protocol a more grounded base of practice, we suggest that

- Further studies need to be carried on comparison between different age groups and duration of practice in dentists.
- Further studies are also recommended using protocols of 6 weeks or longer durations, with subsequent follow ups.
- Electromyography could be used concurrently, to provide additional information on muscle activation associated with any observed postural changes.
- Moreover, future studies could be designed by using a more dynamic and functional outcome measure, instead of using static photographic measure, for forward head posture.

LIMITATIONS

In our study, the sample size taken was small, so a further study with a larger sample would provide a better generalization of the results. Furthermore, subject and researcher blinding was not implemented in our study. It was also realized that the postures observed in a photographic analysis may not reflect those adopted while working.

CONCLUSION

Deep cervical flexor training is more effective than conventional isometric training for improving forward head posture, decreasing pain and disability in dentists suffering from chronic neck pain.

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