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Original Research Article

EFFECT OF HAMSTRING STRETCH PELVIC CONTROL ON PAIN, DISABILITY AND WORK ABILITY INDEX IN DENTIST WITH MECHANICAL LOW BACK PAIN

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ABSTRACT

Background: Dentist sits in a chair and leans forward towards the patient, lumbar curve flattens and the bony infrastructure provides very little support to the spine. Sitting in chair forces the hamstrings to become inactive and places them in a shortened position. Repetitive, prolonged sitting eventually leads to hamstring muscles that adapt to a new shortened length, and the result is Hamstring tightness which induces posterior pelvic tilt and decreased lumbar lordosis, which can result in low back pain.

Objective: We investigated effects of hamstring stretch with pelvic control on pain, disability and work ability in Dentist with mechanical low back pain.

Methods: Thirty Dentist from Dental professional were randomly assigned to pelvic control hamstring stretching (Group A) (n = 15) and Supine hamstring stretching (Group B) (n = 15). All interventions were conducted 3 days per week for 6 weeks, and included in the hamstring stretching and lumbopelvic muscle strengthening.

Outcomes: Outcomes were evaluated through Numeric pain rating scale (NPRS) for Pain, Oswestry disability index (ODI) for Disability, and Work ability index (WAI) for Work ability.

Results: The paired t-test was used to compare within group differences and unpaired t-test was used to compare the between group differences. All statistical analyses were performed using SPSS statistical software version 21.Significant differences found between Group A and group B in all three variables.($p<0.05$).between pre and posttest of subjects. According to the results of the present research, it could be concluded that for reducing pain, disability and improving work ability in dentists pelvic control hamstring stretch and lumbopelvic strengthening exercises are recommended.

Conclusions: The pelvic control hamstring stretch exercise would be more helpful in back pain reduction and improvement of work ability in Dentist with mechanical low back pain.

KEY WORDS: Hamstring stretch, pelvic control, low back pain, dentist, disability.

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INTRODUCTION

In the world of increasing dental problems, dentists are exposed to more number of patients. Simultaneously they are also exposed to increased workloads, which in turn increased the prevalence of a wide variety of musculoskeletal disorders among them. Hayes et al. reviewed the prevalence of musculoskeletal disorders among dentists. It is as high as 64–93 per cent with back contributing 36.3–60.1 per cent, neck 19.8–85 per cent and more severe are hand and wrist contributing the highest, which is 60–69.5 percent [1]. Prolonged static postures (PSP) are inherent in dentistry work. Awkward postures

that involve forward bending and repeated rotation of the head, neck and trunk to one side are common occurrences during clinical work. As posture deviates more from neutral, the muscles that are responsible for the preferred side of rotating or bending become stronger and the matching antagonistic muscles become elongated and weakened, creating a muscle imbalance [2].

Dental procedures are usually long and require much concentration of work. Posture in the sitting position requires less energy expenditure and imposes fewer loads on the lower extremity than standing. Yet, prolonged sitting or unsupported sitting can have deleterious effects on the lumbar spine [3]. The unsupported sitting position places more load on the lumbar spine than standing, as it creates backward tilt, a flattening of the low back, and a corresponding forward shift in the center of gravity. Sitting decreases lumbar lordosis, increases low back muscle activity, disc pressure, and pressure on the ischium (lower posterior portion of the hipbone), all of which are associated with LBP [4]. Previous studies suggest that when a dentist sits in a chair and leans forward towards the patient, lumbar curve flattens and the bony infrastructure provides very little support to the spine. In an attempt to explore strategies that can be used to address the mechanisms leading to musculoskeletal disorders, Velachi & Velachi point out that the spine ends up hanging on muscles, ligaments and soft tissues at the back of spine, causing tension and increased muscular demands in these structures. They found out that ischemia (restriction in blood supply to tissues) can ensue, leading to low back strain and trigger points [2,5].

Higher muscular demands can lead to increased rates of fatigue, and possibly increases in motor control errors during movement, which may leave the passive structures vulnerable to loads beyond their capacities [6]. Sitting in a chair forces the hamstrings to become inactive and places them in a shortened position. Repetitive, prolonged sitting eventually leads to hamstring muscles that adapt to a new shortened length, and the result is tightness in the back of the legs along with potential low back pain [2]. Once back pain lasts over a few months, it is accompanied by a reduction of muscle strength and endurance, loss of flexibility, and lowered balancing ability. This limits effective movement of the lumbar spine and pelvis, causing spinal instability and reducing postural ability. Back pain also makes it difficult to maintain a correct neutral position, consequently causing pain and repetitive damage [6,7].

A comprehensive treatment of chronic back pain that addresses both physical and mental aspects could yield a desirable outcome. There are exercise methods geared towards the functional improvement of patients with chronic back pain including William's exercises, the McKenzie method, stretching, aerobic exercise, yoga, aquatic exercise, and lumbar stabilization exercise [8]. Since these exercise methods focus on increasing lumbar flexibility or strengthening the proximal lumbar muscles, they can exert mechanical stress that can cause muscle injury. In particular, it was noted that the motion of the lumbar spine and pelvis could impact stretching effects in the application of hamstring stretching [9]. Prior studies expected stretching to improve hamstring flexibility, increase task performance ability, prevent injuries, align posture, and affect lumbar spine and pelvic motion [10,11]. It is thought that hamstring tightness induces posterior pelvic tilt and decreased lumbar lordosis, which can result in low back pain [12].

Hamstring extensibility influences spinal posture when trunk flexion postures are performed [13]. Since dentists spend about half of their workday waking hours at the workplace, offering a physical activity program at work may be an efficient strategy for increasing muscle flexibility. However, only a few studies concerning Hamstring-stretching interventions have been performed in the work setting. For these reasons, the aim of this study was to determine the effect of Hamstring stretch with pelvic control performed on the pain, disability and work ability in dentists with mechanical low back pain.

METHODOLOGY

Study Design: Experimental study design

Source of Sample: The study was conducted at Physiotherapy OPD of SGT Hospital, Budhera,

Gurugram.

Sample Size: A total of 30 subjects were randomly assigned into 2 groups. Each group had 15 subjects named as Group A and Group B.

Group A: Hamstring stretch with Pelvic control

Group B: Supine Hamstring stretch

Sampling: Convenience Random Sampling

Inclusion Criteria

i. Male and female subjects diagnosed with Mechanical low back pain by Orthopaedician[14].

ii. Male and female subjects between ages of 25-40 years [15].

iii. Subjects who scored 5 or more than 5 on Numeric Pain Rating Scale (NPRS) [16].

iv. Subjects having Oswerty Disability Index (ODI) score minimum 20% to 40% [17].

v. Subjects having Work Ability Index(WAI) score minimum or more than 25 [18].

vi. Subjects working at least 8 hours per day in sitting position [19].

vii. Subjects having Straight Leg Raise test(SLR) less than 70 [14].

viii.Subjects having Manual Muscle Testing (MMT) minimum grade 3 or more than grade 3 except trunk flexor minimum grade 2 or more than that.

Exclusion Criteria [14]

i. History of fracture and surgery

ii. Patient with disc herniation

iii. Patient with osteoarthritis

iv. Patient with spondylolisthesis

v. Patient with Limb length discrepancy and pregnancy

vi. Patient with systemic disease except Diabetes Mellitus

vii. Patient with low back pain with known cause.

viii. Lasegue test positive

VARIABLES

Dependent variables

i. Pain

ii. Disability

iii. Work Ability index

Independent variables

i. Hamstring stretch with Pelvic control

ii. Supine Hamstring stretch

Instruments &Tools Used

i. Numeric Pain Rating Scale (NPRS)

ii. Oswerty Disability Index (ODI)

iii. Work Ability Index (WAI)

iv. Box for pelvic control

v. Stop watch

vi. Mat

vii. Universal Goniometer

viii. Hot pack

Procedure: Subjects from SGT University, Haryana who fulfil the inclusion criteria were included in the study. Subjects were explained about the significance of study. All the subjects were explained about the procedure to be done to gain their cooperation and confidence. Written informed consent was obtained from all the subjects before participating in the study.

All the subjects were assessed for Pain by NPRS, Disability by ODI and Work ability by WAI for their baseline measurements and subjects were randomly located using convenience random sampling into two groups. Both groups consist of 15 subjects each.

Group A(n =15) Hamstring stretch with Pelvic control.

Group B (n= 15) Supine Hamstring stretch.

Intervention

Group A: Hot fomentation was given by applying lumbar hot pack over the area in prone lying position for 15 minutes [20].

Hamstring stretch with Pelvic control: Subjects were instructed to stand and face the table with their hip square, maintain an erect torso, hold their arms out or on their hips look straight ahead and flex forward at the waist until a Hamstring stretch was perceive. Subject should caution against, and monitor to prevent posteriorly tilting the pelvis or rounding the trunk forward. When the position no longer caused a stretching sensation to the Hamstring, subjects were instructed to increase their trunk flexion [21].

Group B: Hot fomentation was given by applying lumbar hot pack over the area in prone lying position for 15 minutes [20].

Supine Hamstring stretch: Subjects were

instructed to lying supine on the floor with the stretching leg on the wall and the other leg flat on the floor, with the distance from the wall adjusted so that they felt a Hamstring stretch. When the position no longer caused a stretching sensation to the Hamstring, subjects were instructed to slide their bodies closer to the wall [21].

The stretching regimen was performed in a group setting 3 times per week, for 6 weeks. Each stretching session consisted of performing the assigned stretches to each leg 3 times for 30 seconds each. Subjects rested for 15 seconds between stretches and during the rest period removed their leg from the box and wall respectively [22].

Lumbopelvic muscle strengthening exercises [23] included abdominal bracing, bridging and curl up. When patient learnt above three exercises and performed 10 repetitions with 10 seconds, hold than we progressed to prone exercises, first prone with chest lift than prone with alternate arm and leg lifts.

When patient learnt above two exercises and performed 10 repetitions with 10 seconds hold than we progressed to quadruped exercises, first with quadruped with single arm lift than quadrupled with single leg lift.

Postural correction advice was given to both group [24]

Post Assessment: After completion of the 3rd week and after 6thweek, both the group was assessed again with NPRS for pain, ODI for disability and WAI for work ability.

Outcome measures: Pain was measured by NPRS [25], disability assessed by ODI [26] and work ability assessed by WAI [27].

Fig. 1: Hamstring stretch with Pelvic control.

Fig. 2: Supine Hamstring stretch.

RESULTS

Mean comparison of Age, Height, Weight and BMI showed that both groups were homogenous.

Table 1: Subjects' baseline characteristics represented as Mean ± SD.

Variables	Gr-A (n=15) Mean ± S.D	Gr-B (n=15) Mean ± S.D	t-value	p-value
Age (Years)	32.13 ± 4.389	33.33 ± 5.024	0.697	0.492^{NS}
M, n (%)	6(40%)	7(60%)	0.357	0.724^{NS}
F, n (%)	7(60%)	6(40%)		
Height	1.70533 ± 0.07	1.69467 ± 0.08	0.402	0.691^{NS}
Weight	71.27 ± 6.95	70.80 ± 6.70	0.187	0.853^{NS}
BMI (Kg/m2)	24.54 ± 2.42	24.64 ± 1.65	0.144	0.886^{NS}
NPRS	6.13 ± 0.990	6.47 ± 0.990	0.922	0.365^{NS}
ODI	0.23 ± 0.292	0.23 ± 0.292	0	1.000^{NS}
WAI	26.8 ± 3.877	25.73 ± 2.789	0.865	0.394^{NS}

* Significant at p<0.05, ** Highly significant at p < 0.001, NS – Non significant.

Comparison of change in NPRS between both groups: The Mean value ± Standard deviation of NPRS scale for Subjects in group A and B was 6.13±0.990, 6.47±0.990, 3.47 ±0.990, 3.80±1.014, 0.73±0.594 and 2.40±0.507 on baseline, 3rd week and 6th week, respectively. The between group analysis of the NPRS showed that there was significant difference seen at 3rd week (p<0 .05), but a highly significant difference was seen on 6thweek. Unpaired t-test revealed that there was a significant decrease in the NPRS from baseline to last day of 6th week in group A. p <0.001 (Refer table 2)

Table 2: Changes in values for NPRS in comparison to Baseline for 3rd and 6th week between the groups.

Period	Gr	N	Mean	S.D	t	P
Baseline	A	15	6.13	0.99	0.922	0.365^{NS}
	B	15	6.47	0.99		
3rd week	A	15	3.47	0.99	0.911	0.05*
	B	15	3.8	1.014		
6th week	A	15	0.73	0.594	8.268	0.00**

Comparison of change in ODI between both groups: The Mean value ± Standard deviation of ODI scale for Subjects in group A and B was 0.23 ± 0.292, 0.23 ± 0.292, 0.1646 ± 0.0370, 0.1649 ± 0.3720, 0.0880 ± 0.0086 and 0.1190 ± 0.215 on baseline, 3rd week and 6th week, respectively. The between group analysis of the ODI showed that there was significant difference seen at 3rd week ($p<0.05$), but a highly significant difference was seen on 6thweek. Unpaired t-test revealed that there was a significant decrease in the ODI from baseline to last day of 6th week in group A. $p <0.001$. (Table 3).

Table 3: Changes in values for ODI in comparison to Baseline for 3rd and 6th week between the groups.

Period	Gr	N	Mean	S.D	t	P
Baseline	A	15	0.23	0.292	0	1.0^{NS}
	B	15	0.23	0.292		
3rd week	A	15	0.1646	0.037	0.02	0.05*
	B	15	0.1649	0.372		
6th week	A	15	0.088	0.0086	5.23	0.001**
	B	15	0.119	0.0215		

Comparison of change in WAI between both groups: The Mean value ± Standard deviation of WAI scale for Subjects in group A and B was 26.80 ± 3.877, 25.73 ± 2.789, 32.20 ± 2.569, 30.93 ± 1.751, 37.47 ± 1.356 and 33.00 ± 1.393 on baseline, 3rd week and 6th week, respectively. The between group analysis of the WAI showed that there was significant difference seen at 3rd week, but a highly significant difference was seen on 6thweek. Unpaired t-test revealed that there was a significant decrease in the WAI from baseline to last day of 6th week in group A. $p <0.001$ (Refer table 4)

Table 4: Changes in values for WAI in comparison to Baseline for 3rd and 6th week between the groups.

Period	Gr	N	Mean	S.D	t	P
Baseline	A	15	26.8	3.877	0.865	0.394^{NS}
	B	15	25.73	2.789		
3rd week	A	15	32.2	2.569	1.578	0.05*
	B	15	30.93	1.751		
6th week	A	15	37.47	1.356	8.99	0.00**
	B	15	33	1.363		

DISCUSSION

In answer to research question, the findings of this trial indicated out of two groups, the group receiving Pelvic control Hamstring stretch with lumbopelvic strengthening exercise and postural correction had a higher percentage of change in pain, disability and work ability index as compared to Supine Hamstring stretch with lumbopelvic strengthening exercise and postural correction. Therefore, the null hypothesis is rejected.

There were very few studies done on Pelvic control Hamstring stretch with lumbopelvic strengthening exercise and postural correction isolation that shows their effectiveness but the results obtained from this study are novel that proves the combined efficacy of Pelvic control Hamstring stretch with lumbopelvic strengthening exercise and postural correction training administered in Dentists with mechanical low back pain.

The two groups had equal number of subjects and there were no significant differences with respect to their gender distribution, age and body mass index distribution, which could have altered the results of the study. In this study pain decreases significantly in both the Group A and Group B group, but the increase was larger in the Group A.

The result of the study revealed that the Hamstring stretch with pelvic control intervention showed better results with respect to reduction in pain of subjects, disability and improvement in work ability as measured by NPRS, ODI and WAI, respectively.

Between the group analysis for NPRS revealed that significant improvement in both the groups at 3rd week and 6th week with p value < 0.05 and $p <0.02$ respectively. In comparison to Group B, Group A showed better improvement at 3rd and 6th week from 9.51% to 28%.

Between group analysis for ODI showed significant improvement in both the groups noticed at 3rd week and 6th week with $p < 0.05$ and $p <0.02$ respectively. Group A were highly significant than Group B at 6th week. There was percentage improvement from 0.18 % to 35.2% from 3rd week to 6th week.

Between-group analysis for WAI showed significant Improvement in both the groups noticed at 3rd week with p value <0.05 and 6th week with $p < 0.02$. Group A were highly significant than Group B at 6th week. There was percentage improvement from 3.99 % to 11.2% from 3rd week

to 6th week.

Bethany Valachi and Keith Valachi et al 2003 concluded that Dental operator spend most of the their working hour in prolonged static seated posture [2]. Prolonged sitting work habit causes Hamstring tightness because during sitting the Hamstring muscles are inactive, and held in shortened length. This is the propable cause of tight Hamstrings in Dentists, which causes back pain. According to Hyun et al Hamstrings, tightness induces posterior pelvic tilt consequently reducing pelvic control ability [14]. Therefore, in this study hamstring stretching with pelvic control included, which may be proven more helpful in back, pain reduction and improvement of work ability in Dentist with low back pain.

Richardson C, Jull G et al found that LBP was most frequent in the age group of 30 to 40 years. A possible cause for work-related LBP among dentists could be the imbalance in muscles between the lower back and abdominal muscles that occurs due to prolonged sitting posture of the dental professionals. This could be the most important factor associated with poor WAI at baseline data. Repeated leaning towards the patient may lead to strain and overexertion in the lower back extensor muscles whereas simultaneously the deep abdominal muscles become weaker [28].

Similarly, Van Tulder M et al also stated that some specific exercises which promotes contraction of the deep trunk muscles with transversus abdominis and multifidus contraction is beneficial for reducing pain and disability in patients with chronic LBP [29].

Therefore, lumbo-pelvic strengthening exercises included in this present study, which would be more helpful in, pain reduction and improvement of work ability index in Dentist with low back pain.

According to Le Decoster et al, supine Hamstring stretch is comparably more effective than pelvic control Hamstring stretch [21].

Although in present study we found in many cases in which during supine self-stretching patients either lift their pelvis or fold their other knee or lift the other leg if knee is straightened. During this present study we found that in supine Hamstring stretch when a subject is completely supine (on their back) the lumbar lordosis got flatten, causing the posterior pelvis tilt, which shortens the Hamstrings from the hip attachment. We also found that during supine lying Hamstring stretch, the ipsilateral hip and contralateral leg lift off the ground, because of the tight Hamstring muscle. Due to this tightness, the stretching in supine lying produces posterior pelvic tilting. This is why we have taken Pelvic Control Hamstring stretch in standing position.

Sullivan et al demonstrated that stretching in a position of anterior pelvic tilt results in a significantly greater increase in Hamstring flexibility [30].

According to Laura C Decoster explained in her article that supine Hamstring stretch does not require any specific pelvic position because it is already in stable pelvis position [21].

Therefore, we did not emphasize on pelvic control in supine Hamstring stretching. However, in pelvic control Hamstring stretch we instruct the subject to control their pelvis in the anterior tilting position.

Similarly Amr Almaz Abdel –aziem et al 2013 also proved in their article that supine Hamstring stretch and standing Hamstring stretch with pelvic control both are equally effective in increasing Hamstring flexibility [31].

Muyor JM, López-Miñarro PA, Casimiro AJ et al stated in their article on" Effect of stretching program in an industrial workplace on Hamstring flexibility and sagittal spinal posture of adult women workers" found that Hamstring flexibility is recognized as an important component of physical fitness and plays a substantial role in protecting the spine. Reduced Hamstring muscle extensibility has been proposed as a predisposing factor for low back disorders and changes in lumbopelvic rhythm [32].

Rafeemanesh E, Jafari Z, Kashani FO, et al. stated that Dentists are able to recognize and identify their own postures and equipment usage patterns that lead to high risks for musculoskeletal pain, especially LBP. Such recognition is the first critical step to neutralize non-ergonomic behavior and reduce risks to dental practitioners. The present data indicate that prophylactic and therapeutic measures should

be encouraged to prevent cervical and back pain in this affected occupational group. The results of the present study support previous findings that improvements in functional parameters and increase in work productivity occurred in dentists who received physical therapy [33].

Morse et al 2003 performed a study to estimate the effects of abdominal muscle co-activation on lumbar spine stability with the study design beingbased on the biomechanical model of lumbar spine. The study provided estimates of the effects of antagonistic abdominal muscle co-activation, indicating its probable role in lumbar spine stability [34].

Stretching three times, a week with a reduced volume is sufficient to improve flexibility in middle-aged women [22].

Present study also showed significant improvement in WAI in the Group A and Group B after the intervention, which appears to be due to a reduction in the pain index and disability index. Chairside stretching provides a break from these static postures and can prevent pain. In ideal postures, the deep postural stabilizing muscles are still statically contracted. When these muscles fatigue, poor posture can result, and it is back to the "hunched" posture again. Stretching provides a break for and replenishes these muscles with oxygen and nutrients [35]. Bethany Valachi, et al 2002 stated that it is not always possible to maintain "ideal" postures throughout the workday. Intermittently, when hygienists do find themselves in awkward postures, they are usually bent or leaning repeatedly in the same direction, which can result in tightness on one side of the body over the other. Directional stretching reverses the operator position, thereby improving flexibility and decreasing the likelihood of painful muscle imbalances, ischemic muscles [2]. To conclude both groups were found to be effective in reducing pain, disability and work ability index. Results of the study revealed that stretching of Hamstring muscle with pelvic control means stretching of Hamstring muscle in anterior pelvic tilt position training program will brings better improvements in terms of reducing pain, disability and improving work ability index.

Limitations of the study: Sample size was small. Follow up of the subjects was not done to see if the effects are retained. Specification of the work was not mentioned.

Relevance to clinical practice: Combinations of various physical treatments have been done before for improving strength, reducing pain and disability. But till date very few researches has been done to determine the effectiveness of Hamstring stretch with pelvic control and lumbopelvic strengthening exercises on pain, disability and work ability index in Dentists with Mechanical LBA Therefore, this research would come out with more appropriate and acceptable treatment protocol for Dentists with Mechanical LBA and therapists and will contribute towards evidence based practice

Future research: Study can be done on the wider sample. Study can be done on different subjects and different age groups. Study can be done on the basis of specifications of the work like in oral surgeons, endodontics etc. Further research can be done on the long-term effects of the Hamstring stretch with pelvic control on the subjects with mechanical low back pain.

Conflicts of interest: **None**

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