

# Assessment of ergonomics to study the correlation between physical and psychological factors with prevalence of musculoskeletal disorders in practicing dentists

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## Abstract

**Introduction:** Musculoskeletal disorders are very commonly seen in dentists. These disorders can hinder their clinical practice and at times results in severe complications leading to an early retirement.

**Aim:** The aim of this study is to find a correlation between physical and psychological factors with the prevalence of musculoskeletal disorders in practicing dentists. This study is a culmination of two fields of medicine, physiotherapy and dentistry, thus proving to be of significant value in terms of interdisciplinary approach to healthcare.

**Materials and Methods:** The sample size consisted of 50 dentists. It was an observational cross-sectional study with a questionnaire divided into three sections. Inclusion and exclusion criteria includes Section 1 - Demographic data and basic questions related to the aim of the study. Section 2 - Cornell Musculoskeletal Disorder Questionnaire. Section 3 - General Health Questionnaire-12 for assessment of psychological stress.

**Results:** Wrong posture, existing physical illness, lack of exercise and increases levels of psychological stress increase the prevalence of musculoskeletal disorders.

This study could be used to implement better treatment options to dentists suffering from musculoskeletal disorders considering both physical and mental factors.

**Conclusion:** It is very important to increase the awareness of ergonomics and the influence of psychological stress in practicing dentists so that they can avoid these disorders and provide a high-quality treatment to their patients without any hindrance in their professional careers due to these disorders.

**Keywords:** Musculoskeletal disorder, occupational hazards, stress

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## INTRODUCTION

The working environment is a basic setup for an individual to be in comfort with the work they are subjected to. In Greek, “Ergo” means work, and “Nomos” means natural

laws or systems. Ergonomics, therefore, is an applied science concerned with designing products and procedures for maximum efficiency and safety.<sup>[1]</sup> The profession itself demands a lot of postural variations which causes

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discomfort to the dentists, thereby leading to serious illness on long exposure. Among the various aches or pains, the musculoskeletal discomfort starts initially with mild signs and symptoms. If these are ignored and it persists, the adverse effects start with back pain, followed by neck pain, high muscle tension on the trapezoids, tendinitis, carpal tunnel syndrome, nerve trapping, early arthrosis, myopia and auditive alterations.<sup>[2,3]</sup> Dental professionals have evolved from two-handed dentistry to four-handed dentistry over time with rise in back, neck, shoulder and arm pain, in almost 81% of them.<sup>[4]</sup> The National Institute for Occupational Safety and Health has classified musculoskeletal disorders as the second most common disease resulting from work, with respiratory diseases being the first.<sup>[5]</sup> The use of ergonomically well-adjusted equipment has definitely helped to overcome the shortcomings of dentistry but, a number of nonspecific biobehavioral mechanisms have been hypothesized to delineate how stress may affect the physiological processes involved in common musculoskeletal disorders.<sup>[6,7]</sup> One biobehavioral hypothesis for how exposure to work-related stressors may be associated with physiological processes involved in low back pain is that certain individuals possess a predisposition to respond to stress with increased paraspinal muscle activity, which may lead to ischemia, reflex muscle spasm, oxygen depletion and the release of pain-producing substances (e.g., histamine and substance P). It has been proposed that this increased reactivity to stress results in a feedback loop that involves subsequent increased pain, triggering further increase in muscle activity, psychological distress and pain.<sup>[8]</sup> The present study establishes a correlation between increased stress levels and increased pain, discomfort which further transforms into musculoskeletal disorder and becomes a chronic condition.

The aim of this study is to find a significant correlation between physical factors such as posture related to working and psychological factors such as stress in correlation to musculoskeletal disorders in practicing dentists.

## MATERIALS AND METHODS

The study sample consisted of 100 practicing dentists in Mumbai and Navi Mumbai. The questionnaire was circulated among the dentists to gather the data. Two methods were used to circulate the questionnaire – manual forms and an e-form (Google Forms). The questionnaire was divided into three sections. The study included only practicing dentists, performing a substantial amount of dental work on patients in a private practice or a college setup. Undergraduates were excluded from the study.

Section 1 - This section consisted of questions to collect data based on the following parameters:

### Demographic data

- Qualification and years of experience
- Questions related to basics of daily practice in the clinic
- Questions related to posture while working
- Medical history if any (general and musculoskeletal history)
- Questions to understand the physical fitness of the participant.

Section 2 - This section consisted of the Cornell's Musculoskeletal Disorder Questionnaire to access the factors related to the areas of pain and discomfort. It focuses on the frequency, severity of the discomfort and whether it is preventing the participants in their occupation or not. All three factors included a scale to make the outcome data to be qualitative.

Section 3 - This section consisted of the Perceived Stress Scale (PSS). The PSS is a classic stress assessment instrument. The tool, while originally developed in 1983, remains a popular choice for helping us understand how different situations affect our feelings and our perceived stress. The questions in this scale ask about feelings and thoughts during the last month. In each case, you will be asked to indicate how often felt or thought a certain way.

### Statistical analysis

Descriptive and inferential statistical analyses were carried out in the present study. Results on continuous measurements were presented as mean and standard deviation. Level of significance was fixed at  $P = 0.05$ , and any value  $\leq 0.05$  was considered to be statistically significant.

Chi-square analysis was used to find the significance of study parameters on categorical scale. The statistical software IBM SPSS statistics 20.0 (IBM Corporation, Armonk, NY, USA) was used for the analyses of the data, and Microsoft Word and Excel were used to generate graphs and tables.

## RESULTS

When the data were statistically analyzed, it were observed that only a few questions gave a significant result and a valid correlation. Improper posture and occupational stress were the two major reasons observed in the study for pain and discomfort in the practicing dentists.

Standing and sitting dentistry were practiced by different practicing dentists, and the results have been tabulated below according to low and moderate levels of stress [Figure 1 and Tables 1 and 2]. Treatment options varied among dentists, out of which, 65.6% opted for physiotherapy, 43.8% opted for medication and rest 10% went for other forms of treatment. Seventy percent of dentists who did not take any breaks while working experienced moderate levels of stress and 59.7% of dentists who took break in between experienced moderate levels of stress [Figure 2]. 70.8% of dentists who do not exercise experience a moderate level of stress and 56.5% of dentists who exercise experience a moderate level of stress. Considering the Cornell Musculoskeletal Disorder test and the Perceived Stress test comparison, the following results were obtained and tabulated [Tables 3-5]. Pain in the right and left upper arm [Figures 3 and 4], forearm [Figures 5 and 6] and wrist [Figures 7 and 8] proved to be an important factor experienced by almost all the participants which were directly proportional to moderate amount of stress. While considering the upper back pain, 33.3%–66.7% of dentists experienced pain at least once every day [Figure 9], and considering the lower back pain, 22.7%–77.8% of dentists experienced pain at least once every day [Figure 10]. A few dentists also complained of pain in the thighs, buttocks and knees at very few occasions but those values were not statistically significant.

## DISCUSSION

Musculoskeletal agony is a significant issue among dental staff that influences proficiency and occupation fulfillment; the superb justification this might be credited to unseemly working environment ergonomics. The abnormal stances all the more oftentimes distinguished among dental experts are outrageous forward-head and neck flexion; trunk tendency and pivot toward one side; lifting one or the two shoulders; expanded curve of the thoracic vertebral segment and wrong situating of the lower appendages with thigh-leg point of under 90°. In the Indian setting, where

quantities of rehearsing dental specialists are consistently expanding, there is a proceeded with expansion in the pervasiveness of musculoskeletal issues.<sup>[5]</sup> Roughly, 59% of dental experts take breaks during clinical strategies and which is in understanding to the applied word related and ecological cleanliness rules who suggest in any event 6 min of rest each hour for experts who perform dull developments.<sup>[9-11]</sup> In the current examination, it was likewise seen that 62.9% of dental specialists experience the ill effects of solid agony because of their clinical practice, which is in understanding to 62% predominance find by Szymańska<sup>[12]</sup> and practically comparative outcomes were investigated by Yousef *et al.*<sup>[3]</sup> and Diaz-Caballero *et al.*<sup>[2]</sup> and in concurrence with Lalumandier *et al.*<sup>[13]</sup> Harutunian *et al.* states that 72%–80% of dental specialists endure torment in the cervical region because of consistent bowing while at the same time working which is in consent to the present

**Table 1: shows participants who practice dentistry in different positions with low level of stress.**

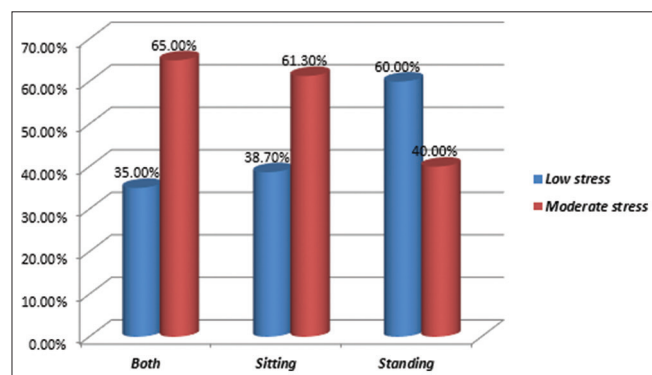
Low level of stress	
60% dentists	Standing position
38.7% dentists	Sitting position
35% dentists	Both standing and sitting position

**Table 2: shows participants who practice dentistry in different positions with moderate level of stress.**

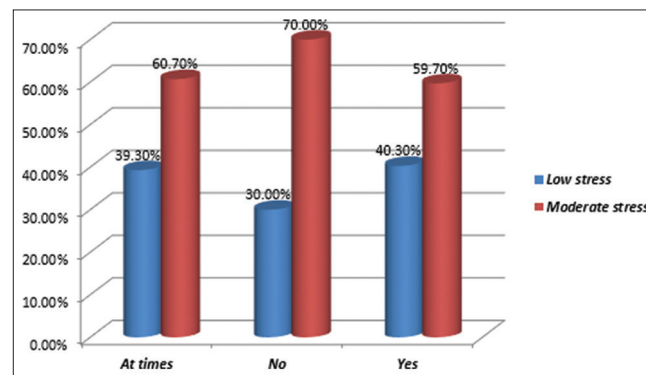
Moderate level of stress	
40% dentists	Standing position
61.3% dentists	Sitting position
65% dentists	Both standing and sitting position

**Table 3: Cornell Musculoskeletal disorder Test and the Perceived Stress Test- Pain in the neck**

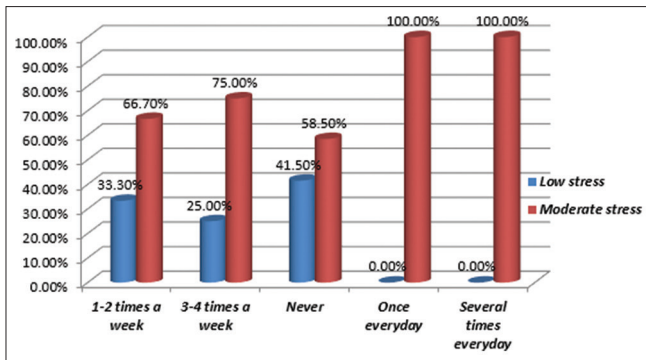
Duration	Level of Stress	Participants in %
Once a week	Moderate level of stress	80%
1-2 times a week	Low - moderate level of stress	52.4%
3-4 times a week	Low - moderate level of stress	62.4%
Several times a day	Low - moderate level of stress	66.7%



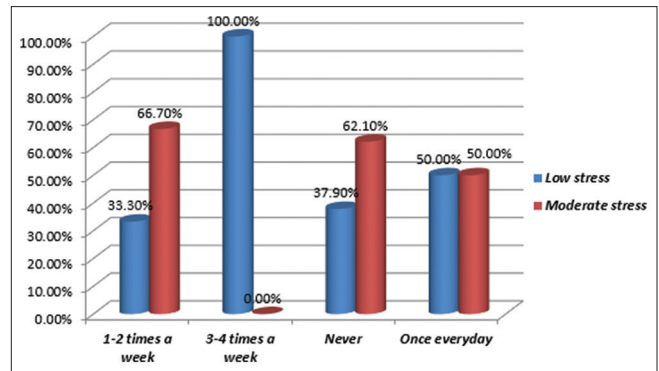
**Figure 1:** Shows the bar graph depicting the position practiced by dental professionals most of the times



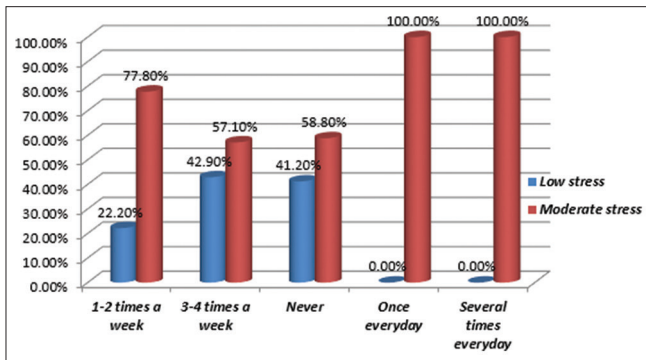
**Figure 2:** Shows the bar graph depicting whether the dental practitioners took breaks in between their dental procedures



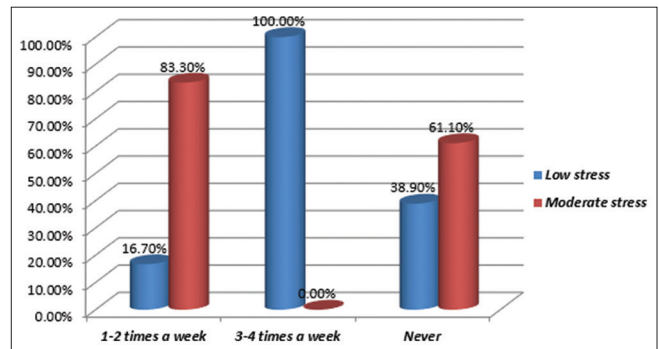
**Figure 3:** Shows the bar graph depicting the pain in the right upper arm. 100% of the participants experienced pain once every day and 75% of the participants experienced pain 3 to 4 times a week



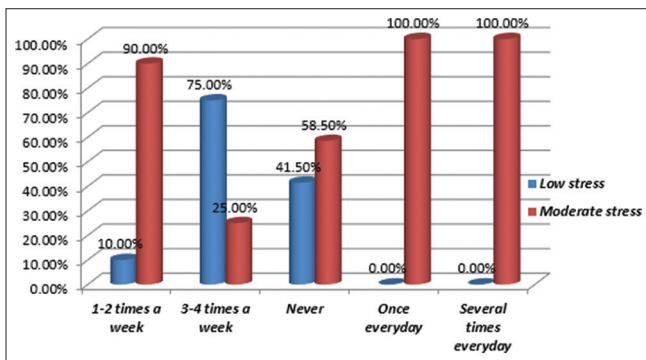
**Figure 4:** Shows bar graph depicting the pain in the left upper arm. 100% of the participants experienced pain at least 3 to 4 times a week and 66.7% of them experienced pain 1 to 2 times a week



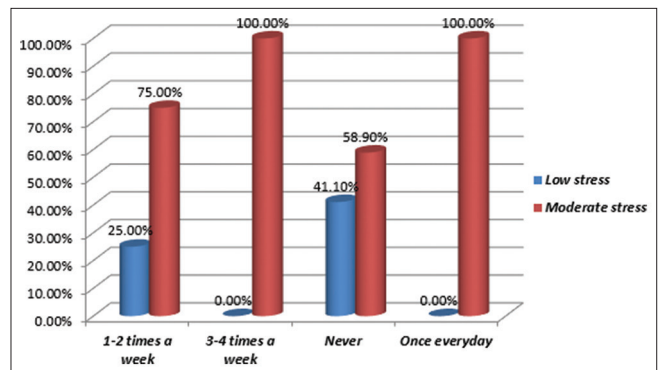
**Figure 5:** Depicts bar graph showing pain in the right fore arm with 77.8% of the participants experienced pain 1 to 2 times a week and 55.8% of the participants never experienced pain in the right forearm



**Figure 6:** Shows bar graph showing participants experiencing pain in the left forearm 1 to 2 times a week (83.3%)



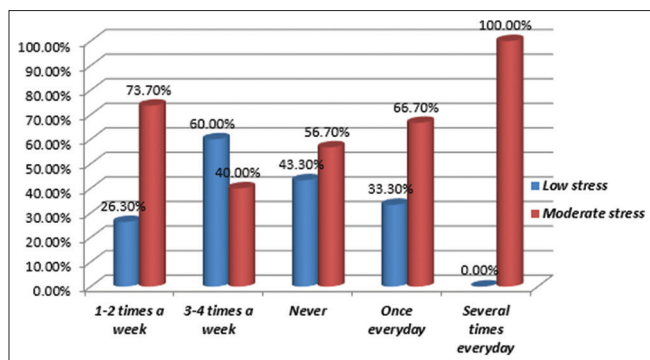
**Figure 7:** Depicts bar graph showing 90% of the participants experiencing pain on the right wrist.



**Figure 8:** Depicts bar graph showing 75% of the participants experienced pain 1 to 2 times a week whereas 58.9% of the participants never experienced pain

study. There were 92.3%, 83%, 78%, 78% and 64% of dental specialists who announced comparative grumblings in examinations from Iraq, Saudi Arabia, Sweden, Thailand and Australia, respectively.<sup>[14-17]</sup> Our present investigation was in co-mandate with the investigation dependent on Australian dental specialists. In the current investigation, it was additionally seen that a higher level of dental specialists who experienced torment encountered a low or moderate measure of pressure.

Cooper *et al.* demonstrated that reasons for pressure among dental specialists included too little work, regulatory troubles, endeavors to set up a training and managing diverse patients.<sup>[18]</sup> For psychological well-being, the results can incorporate burnout, burdensome issues, diminished inspiration and confidence; interestingly, the most usually detailed pressure-related actual medical problems are lower back torment, expanded musculoskeletal grumblings, migraines and gastrointestinal problems.<sup>[19-21]</sup>



**Figure 9:** Shows bar graph depicting the upper back pain. Almost all the participants have pain all day long, 73.7% of the participants experience pain 1 to 2 times in a week and 66.07% of them experience pain once everyday

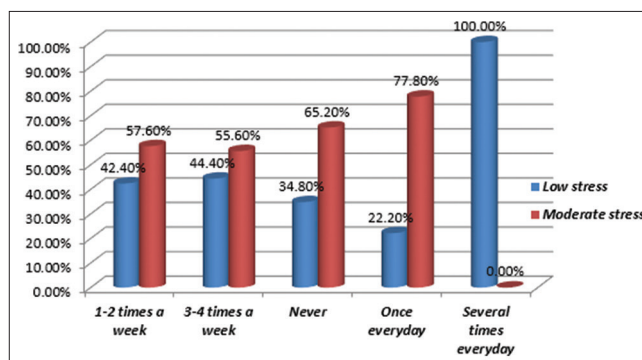
**Table 4: Cornell Musculoskeletal disorder Test and the Perceived Stress Test - Pain in the right and left upper arm**

Duration	Right	Left
Several times a week	50%	50%
Once a day	100%	50%
1-2 times a week	25-75%	33.3-66.7%

**Table 5: Cornell Musculoskeletal disorder Test and the Perceived Stress Test - Pain in the right and left forearm**

Duration	Right	Left
1-2 times a week	77.8%	83.5%
3-4 times a week	57.1%	50%

All the dental specialists who whined of agony likewise encountered a low to direct even out of pressure. Work can trigger a mind-boggling set of social, psychological and physiological reactions or strains, usually alluded to as the pressure reaction. The pressure reaction is normally connected with fundamental and limited physiological changes that are expected to restore a natural condition of homeostasis as per Selye. It is hypothesized that repetitive or persistent openness to a wide scope of inborn or extraneous stressors or requests more than once brings out a pressure reaction, which, thus, adds to the etiology, intensification and upkeep of various pervasive well-being problems.<sup>[22]</sup> Many models of human pressure suggest that the presence and seriousness of a pressure reaction are relative to a person’s examination of the degree of danger addressed by the particular stressor. Psychological cycles (e.g., feelings, practices and memory) engaged with pressure examination or assessment and resulting reaction are accepted to trigger the organic outcomes of stress. Various vague bio conduct systems have been estimated to depict what stress may mean for the physiological cycles associated with normal musculoskeletal disorders.<sup>[23]</sup> At present, these endeavors have not recognized explicit pathways connecting pressure to back or furthest point torment, however, they do give general data that offers a



**Figure 10:** Shows bar graph depicting the lower back pain. Almost all the participants experience lower back pain several times a day, whereas 77.8% of the participants experience pain once everyday, and 65% of the participants never experienced such an issue

fundamental structure for distinguishing such pathways later on.

The peripheral pain receptors (nociceptors) thought to be responsible for the initiation of back pain have been identified. Nociceptors responsive to mechanical deformations have been identified in facet joint capsules, spinal ligaments, bone and the outermost fibers of the disc annulus fibrosus, but not in the disc nucleus. The response of spinal nerve roots and dorsal root ganglia to compression, vibration and chemical stimuli has been analyzed in part. One biobehavioral hypothesis for how exposure to work-related stressors may be associated with physiological processes involved in low back pain is that certain individuals possess a predisposition to respond to a stressor with increased paraspinal muscle activity, which may lead to ischemia, reflex muscle spasm, oxygen depletion and the release of pain-producing substances (e.g., histamine and substance P).<sup>[8]</sup>

The present study showed a positive correlation between the frequency of pain and level of stress by a comparison of parameters between Cornell Musculoskeletal Disorder Questionnaire and Perceived Stress test.

## CONCLUSION

It is very important to increase the awareness of ergonomics and the influence of psychological stress in practicing dentists so that they can avoid these disorders and provide a high-quality treatment to their patients without any hindrance in their professional careers due to these disorders. Newer techniques need to be developed to improvise the work-related conditions of dentists and also a special focus should be given to psychological stress and its effects with respect to physical ailments and in this case musculoskeletal disorders.

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## Limitation

As the sample size is very small, there would be variations in final results with chances of significant values.

## Financial support and sponsorship

Nil.

## Conflicts of interest

There are no conflicts of interest.

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