

Assessment of Factors Contributing to Work-Related Musculoskeletal Disorders among Dental Students

*Aishwarya A.¹, Anjali, Pushpanjali K.² and Shwetha K.M.³

*Corresponding Author E-mail: aishwaryapanangat@gmail.com

Contributors:

¹Post Graduate Student, Department of Public Health Dentistry,

²Head of Department, Department of Public Health Dentistry,

³Reader, Department of Public Health Dentistry, Faculty of Dental Sciences, M.S. Ramaiah University of Applied Sciences, Bangalore - 560054

Abstract

Work-related musculoskeletal disorders are highly prevalent among dentists. Following correct dental ergonomics is important to prevent the occurrence of such disorders. This study assessed the factors contributing to work-related musculoskeletal disorders among dental students at FDS, RUAS. Majority of the students were maintaining appropriate postures while performing clinical procedures except for excessive forward head tilting or neck bending. However, a nearly negligible proportion of students practiced other ergonomic practices like taking breaks or doing chair side stretching exercises or practiced four-handed dentistry. Teaching and encouraging dental students to adopt ergonomic practices must be mandatory in all dental institutions.

Keywords: *Ergonomics, Musculoskeletal Disorders, Operating Stool, Dentists*

1. INTRODUCTION

In dentistry, the prevalence of work-related musculoskeletal disorders among dentists ranges from 63 to 94%, with the main contributing factors being repetitive movements and Prolonged Static Postures (PSPs)¹. Across all dental specialties, irrespective of the qualification, the most commonly affected anatomical sites are the neck and lower back areas attributed to frequent forward positioning by the dentist for better visualization or access to the oral cavity². Musculoskeletal disorders if left untreated in the long run have a negative impact on the professional life of the dentist who then either completely abandon or limit their clinical duties³.

The term 'Ergonomics' has been gaining popularity over the years, especially in dentistry. In relation to dentistry this discipline deals with numerous concepts, starting from the way the dentist positions himself while performing clinical duties to the design of his working environment and other factors that permit optimal productivity in his occupation without having any adverse outcomes on his physical or general health^{4,5}. The overall goal of dental ergonomics is to create a working environment that is not only safe but also comfortable for the dentist, thus preventing any physical and/or psychological

deficits in him or her⁶. Musculoskeletal disorders have been cited as one of the reasons contributing to about 25% of early retirement in the dental profession⁷.

A study done among Dutch dentists found that those dentists who were at a higher risk for a professional burnout tended to have a greater extent of health problems than those at a lower risk⁸. Another study done among dental students has reported that there is a slight to moderate significant positive correlation between the perceived difficulties of applying ergonomic practices and performing preclinical restorative procedures, the same authors also reported that students' perception of the difficulty of adopting ergonomic practices reduced with the time through the duration of the course work⁹. Dental institutions become an important platform for young dentists to be trained to adopt correct ergonomic practices while also providing the students an ergonomically designed working area. Assessing the postural inadequacies among dental undergraduates and postgraduates along with their adherence to other ergonomic practices and ergonomics design will help plan effective strategies to prevent work related musculoskeletal disorders among budding dentists¹⁰. Therefore, the aim of this study was to assess the factors contributing to work-related musculoskeletal disorders among dental students

at Faculty of Dental Sciences, Ramaiah University of Applied Sciences (FDS, RUAS).

2. METHODS AND METHODOLOGY

An observational study was conducted in all clinical departments at Faculty of Dental Sciences (FDS) from December, 2016 to January, 2017. A study tool was developed to assess the adherence of dental students to ergonomic practices while providing chairside care to patients.

Study Tool

A comprehensive study tool was developed which assessed three domains in ergonomics namely; Physical, Cognitive and Organizational domains. Personnel related and external factors were assessed for the physical domain. Under the cognitive domain, items pertaining to communication and relaxation techniques were assessed. The organizational domain assessed appointment scheduling and dental assistance. The complete tool had 34 items intended for direct observation of the compliance of dental students to postural requirements while performing specific tasks, such as Sitting at the dental operatory, Positioning of patient and dental chair, Instrument grasp and Positioning of instrument tray. Items assessing compliance of the existing dental armamentarium with ergonomic designs was also to be directly observed. The tool also included interview-based questions directed at dental students pertaining to performance of chairside stretching exercises, alteration between body postures, practice of four-handed dentistry and type of appointment scheduling practiced.

Nominal scales of measurement were adopted for all the 34 items. Items on the tool were checked as 'Yes', 'No' or 'Not Applicable'. The tool was subjected to face and content validation by subject experts. The tool was then pilot tested to arrive at an appropriate sample size of 91 individuals by applying the formula $4pq/L^2$, where $p=65\%$, $q=1-p$, $L=10\%$. Permission was sought from heads of all clinical departments at FDS prior to start of the study to observe dental

students while they provide chairside dentals services. The first and second authors were trained and calibrated in the Department of Public Health Dentistry. They were explained the principles of ergonomics pertaining to correct body positioning, manipulation of instruments and the adequacy of dental equipment and armamentarium by the head of the department and then administered the developed tool on dental students. Both investigators had a sound knowledge of the tool and showed good inter examiner reliability of 0.85.

Data Collection

Data was collected by the first and second authors who administered the tool on dental students providing chair side clinical care on patients assessed by direct observation technique in a surreptitious manner, as an attempt so as to not hamper the delivery of the service to the patient by the performing dentist. For assessing the task, 'Sitting at the dental operatory', to identify non-compliant postures, the observers used a 90 degree angle (scaled to size) printed on an A4 sheet as reference which was found to be a reliable method to correctly identify postural inadequacies in an objective manner. Compliance with cognitive and organizational ergonomic components of the tool was assessed by asking close-ended questions to the participating dental students by the investigators.

The data so obtained was entered on to a Microsoft Excel spreadsheet and descriptive statistics in the form of percentages were computed.

3. RESULTS

Ninety one dental students comprised of 68 females and 23 males were included in this study and their adherence to ergonomic practices while providing chair side clinical care to patients was assessed. The mean age of the participants was 23+3 years. Table 1.1 depicts the adherence percentage of dental students to ergonomic practices in the physical, cognitive and organizational domains assessed through direct observation and close-ended questions.

Table 1. Percentage of dental students showing adherence to ergonomic practices

Ergonomic requirement	Percentage (%)
Domain 1: Physical Ergonomics	
Personnel Observation	
<u>Task: Sitting at the Dental operator</u>	
Seated symmetrically upright (upper body perpendicular to the floor)	88.9
Seated as behind as possible in the operators stool	62.5
Forward upper body tilt between 10 to 20°	83.3
Forward head tilt of not more than 25°	33.3
Upper limbs positioned in front of the trunk of the body	83.3
Working field or patients' mouth aligned with the front of the upper body	88.9
35 to 40 cm distance between the working field and operator's eyes	61.1
More than 110° between the upper and lower leg	38.9
Pedal drive positioned within 15 to 20 cm of one of the feet	50.0
Heel of the feet on the floor while operating	50.0
<u>Task: Positioning of patient and dental chair</u>	
Free movement of operator's thighs below dental chair	81.3

Supine patient position for maxillary procedures	55.6
Semi-supine patient position for mandibular procedures	16.7
<u>Task: Instrument grasp</u>	
Appropriate Instrument grasp	68.8
<u>Task: Positioning of instrument tray</u>	
Instrument tray positioned within 20 to 25 cm of operators waist	66.7
Instrument tray height positioned at operators waist level	18.8
Observation of Dental Armamentarium	
Operators stool with height adjustability, seat pan and back rest	100
Operators stool with arm rest	0
Operating light with three axes	100
Adjustable illumination of operating light	100
Domain 2: Cognitive Ergonomics	
Cordial interaction with patients and co workers	62.9
Performs stretching exercises during care sessions	0
Alternates between body postures during care sessions	6.4
Domain 3: Organizational Ergonomics	
Alternates between simple and complex procedures while scheduling appointments	24.3
Uses four handed dentistry	0

4. DISCUSSION

In comparison to the general population, dental professionals are at a greater risk for developing work-related musculoskeletal disorders³. Work-related Musculoskeletal disorders in dentistry is attributed to a myriad of risk factors, starting from improper posture, poor equipment design of the workstation, maintenance of prolonged static postures without proper rest or stretching exercises to environmental and/or organizational factors like strenuous scheduling of appointments without breaks⁴. In the present study, a tool was developed to comprehensively assess the factors contributing to work-related musculoskeletal disorders among dental students providing chair side care to patients. The adherence of dental students to ergonomic practices in the physical, cognitive and organizational domains was assessed by the administration of the tool. Though the dental students fulfilled a majority of the postural requirements in the physical domain, adherence to ergonomic practices in the cognitive and organizational domains was unsatisfactory. Postural requirements like forward tilt of the upper body or torso, position of upper limbs and proper alignment of the working field in front of the body were satisfied by more than 80% of dental students observed in this study. These values are in agreement with a study by Garbin *et al* in 2011, showing similar adherence¹¹. However, in the present study 66.7% dental students were observed to be performing excessive forward head tilting or neck bending for better visualization of the working field as compared to 89% in a study done in 2012¹². Pertaining to lower limb posturing, 50% of the dental students observed had positioned the pedal drive correctly with heel of the feet on the floor while only 38.9 % of students demonstrated correct angulation of more than 110o between upper and lower leg. Correct positioning of legs and correct positioning of feet on pedal drive was observed among 34.7 % and 30% respectively in another study¹¹. Appropriate positioning of the lower limbs prevents development of varicose veins, and provides a broader base of support for the body thereby minimizing the risk of inflammation and pain owing to an impeded venous return¹³.

In the present study, 81.3% of dental students allowed free movement of legs below the dental chair in this study. However, in a qualitative study, dental students have expressed that they used to lower the dental chair, thus compressing their legs and elevate the dental stool for better visualization of the patients who had a limited mouth opening¹⁴.

According to this study, there is availability of ergonomically designed dental equipment, except for presence of dental stools with an arm rest for elbow support. Literature reports that increased cost would be one of the barriers for a lack of ergonomically designed dental equipment and 59% of dental students in another study reported a lack of appropriate dental equipment¹⁵.

None of the participating dental students performed stretching exercises during patient work and only 6.4% students alternated between body postures during care sessions. In one study, 14% of respondents reported that they did not take any breaks in between patients and performed their duties continuously without stretching in between¹⁶. Taking micro-breaks of 30 to 50 seconds and performing periodic directional chairside stretching in between care sessions go a long way in preventing musculoskeletal disorders among practicing dentists¹⁷. A study by Hille *et al.* reported that 87.1% participating dentists carried out their daily dental work without a dental assistant i.e. they practiced two-handed dentistry, whereas 12.6% practiced four-handed dentistry and only one respondent practiced six-handed dentistry in the same study¹⁶. In the present study none of the dental students practiced four handed dentistry.

Apart from adopting appropriate work postures, ergonomics also deals with the study of the relationship between the practicing dentist and his or her occupational environment which involves their interaction with co-workers and patients¹⁸. Literature reports that those dentists suffering from work related musculoskeletal disorders are often under confident and are riddled with anxiety and these are significant psychosocial attributes that contribute to being dissatisfied with their work^{5, 19}.

Apex bodies for dental education in India like the Dental Council of India (DCI) must develop and disseminate dental ergonomic guidelines that can be used as reference by all dental institutions to be practiced within their institution. This would show the commitment of the dental fraternity to prevent work-related musculoskeletal disorders among dentists in the long run. Training dental undergraduate and post graduate students to adopt appropriate ergonomic practices becomes the responsibility of every dental institution to prevent not only future musculoskeletal pain but also potential burnout or early retirement in the dental profession⁵. Dental faculty must encourage all dental students to practice four-handed dentistry early on in their training period. Collaborating with the Department of Physiotherapy to conduct sessions with dental students, teaching them to perform chair side stretching exercises becomes the need of the hour. Regular continuing dental education programmes pertaining to ergonomic practices must be conducted at all dental institutions¹⁷. Pertaining to ergonomic design of dental equipment, dental institutions must invest in dental loupes and in dental stools fitted with an armrest. Moreover, the tool developed for this study can be used to regularly assess the adherence to ergonomic practices and as a self-appraisal tool by all clinical departments to ensure that they are ergonomically designed. The reports of which must be assessed periodically by the DCI.

5. CONCLUSION

Work-related musculoskeletal disorders are highly prevalent among dentists. Following correct dental ergonomics is important to prevent the occurrence of such disorders. This study assessed the factors contributing to work-related musculoskeletal disorders among dental students at FDS, RUAS. Majority of the students were maintaining appropriate postures while performing clinical procedures except for excessive forward head tilting or neck bending. However, a nearly negligible proportion of students practiced other ergonomic practices like taking breaks or doing chair side stretching exercises or practicing four-handed dentistry. Teaching and encouraging dental students to

adopt ergonomic practices must be mandatory in all dental institutions.

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