

Assessment of Knowledge Regarding Equipment Ergonomics among Interns and Final Year Dental Students in Bareilly

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ABSTRACT

Aim: The aim of the study was to assess the prevailing perception of BDS interns and BDS final year students regarding EE in Bareilly. **Settings and Design:** Authors conducted a cross-sectional survey in December 2020 amidst the BDS intern and final year students of Bareilly International University, Bareilly. **Subjects and Methods:** The data were collected using 18-item custom designed proforma, comprising of questions evaluating student's basic knowledge about EE. **Statistical Analysis Used:** Statistical analysis was done using SPSS version 23. Kruskal Wallis ANOVA was used to compare the responses among the two groups. **Results:** Of 100 subjects surveyed, 45.8% final year and only 20% interns ever used chair side exercises in their clinical work. In addition, only 18.6% of final years and 42% interns believed that the accentuation on EE is less in the current dental curriculum. **Conclusions:** In the current cross sectional study, the participants lacked a proper understanding of EE and the newer advances in the conventional instruments. Within the limitations of this study, we suggest improvising the scenario of an acquaintance of EE in the dental curriculum.

Key words: Equipment ergonomics, final year, Bareilly, musculoskeletal injuries

INTRODUCTION

“Design from the spine and you'll be fine.”

-Carl Heaton

Ergonomics is derived from Greek word, “ergon” means work and “omics” means natural laws.

It is the technique of fitting the work environment conducive to the worker. Ergonomics is, therefore, a science that addresses how to adapt a job to the anatomical, physiological, and psychological character of man in such a way that it increases human performance and well-being. Ergonomics is defined by the International Ergonomics Association as follows: Ergonomics (or human factors) is the scientific discipline concerned with the understanding of human interactions and other system components, and the profession that applies theory, concepts, data, and methods to design to improve human well-being and the overall efficiency of the system. The term ergonomics first entered the modern lexicon when Wojciech Jastrzębowski used the word in his 1857 article “The Outline of Ergonomics, i.e. Science of Work, Based on the Truths Taken from the Natural Science.”^[1]

It is a well-established reality that dental health workers are more vulnerable to work-related accidents and illnesses, precipitating reduced work skills, long-term injury risk, emotional stress, psychosocial difficulties, career abstinence, and associated costs.^[2]

Musculoskeletal injuries (MSIs), which are ironically preventable at times, are very common in these work-related issues.^[3]

Dental surgeons are at a high risk of developing MSI due to the existence of work habits that mainly have repeated motions in a single posture for a prolonged period of time. When paired with incorrect postures, strong gestures, and badly built devices, the same is exaggerated.^[4]

Approximately 64–93% of dentists suffered from MSI in a comprehensive study, and just 32% of injured dentists were found to seek medical assistance, reflecting the neglect of these vital injuries.^[5]

In modulating these work-related pressures, equipment construction plays a dominant role, and ergonomically engineered tools can eliminate many such associated issues.^[4]

Despite rapid advances in the construction of dental instruments, the dentist is always known to use tools based on experience rather than design features and other ergonomic developments.^[6] The successful implementation of ergonomic equipment (EE) ensures high efficiency, disease and injury prevention, and improved employee satisfaction. For the interception of dentistry-related health issues, thorough comprehension and practice of EE by the

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budding dental students is essential. In the early formative years of dental education, if the EE values are not adequately emphasized and practiced, it is extremely doubtful that they will be followed later during their clinical practice. There is no further research in the literature testing the knowledge of the dental student on EE to the best of the author's knowledge.^[6]

METHOD

A questionnaire study was conducted in the month of December 2020 among BDS intern and final year students of Bareilly International University, Bareilly. The sample consisted of total 100 students of which 50 students each belonged to BDS intern and final year. The study population of 100 students voluntarily completed a questionnaire consisting of 18 questions. The study questionnaire was adopted from Singh *et al.* and modified accordingly. The questions of the questionnaire were designed to assess their basic knowledge, attitude, and practice toward dental ergonomics in clinics and hospitals. Data were collected and descriptive statistics were computed for each question's responses. Statistical analysis was done using SPSS version 23. Kruskal–Wallis ANOVA was used to compare the responses among the two groups.

RESULTS

Out of 100 students, 50 each were BDS final year and interns who filled the questionnaire. Differences in their responses were noted among the three groups [Table 1].

DISCUSSION

Ergonomics is the field of adjusting occupational situations and job requirements to the capacities of the working population. Dentistry requires dental staff to be well to ensure patients are provided with quality dental care. In addition to uncomfortable working postures, the occupation requires sustained movement of the head, neck, arms, and back. Studies in the past have highlighted prevalence of MSDs among dentists. Ergonomics helps to minimize cognitive and physical discomfort as smeared in dentistry, avoid workplace disorders related to dentistry practice, and maximize effectiveness, with increased consistency and superior satisfaction for both the practitioner and the patient. Few studies in India are questionnaire based, discussing about the knowledge and application of preventive strategies in dental practice and physical fitness of the dental professional.

A study conducted by Jolanta stated that 22.8% worked in a sitting position, Fraćzak *et al.*, who studied dentists, reported 74.4% changed position (sitting/standing) during work, the rest 15.4% worked exclusively in the standing position and 10.2% sitting down (Szymańska, 2002; Fraćzak *et al.*, 1991).

The current cross-sectional questionnaire research was the first systematic evaluation of the EE awareness of interns and PG dental students and revealed fascinating and unseen areas of this vast and vibrant sector. Considering their representation of the student

Table 1: Responses to questions about respondent's knowledge regarding equipment ergonomics, by percentage of total respondents ($n=100$)

Questions	Final year (%)	Interns (%)
Ergonomic principles apply only to clinician's position, but not to equipment's?		
Agree	9 (15.3)	19 (39)
Disagree	27 (45.8)	23 (46)
Maybe	5 (8.5)	7 (14)
No idea	9 (15.3)	1 (2)
Do you consider that the musculoskeletal problems are not related to wrong equipment ergonomics?		
Agree	4 (6.8)	12 (24)
Disagree	36 (61)	14 (28)
Maybe	10 (16.9)	24 (48)
No idea	0 (0)	0 (0)
Dental chair ergonomics is not needed for maintaining the operator's neutral position		
Agree	2 (3.4)	4 (8)
Disagree	36 (61)	39 (78)
Maybe	7 (11.9)	7 (14)
No idea	5 (8.5)	0 (0)
Should the operator chair height be adjusted so that hips are slightly higher than knees?		
Agree	41 (69.5)	4 (8)
Disagree	3 (5.1)	22 (44)
Maybe	5 (8.5)	17 (34)
No idea	1 (1.7)	7 (14)
New ergonomically designed operator stools such as saddle seats and trishaped seats prevent low back pain		
Agree	28 (47.5)	24 (48)
Disagree	12 (20.3)	10 (20)
Maybe	10 (16.9)	14 (28)
No idea	0 (0)	2 (4)
Light weight instruments do not help to reduce muscle workload		
Agree	7 (11.9)	36 (72)
Disagree	23 (39)	6 (12)
Maybe	5 (8.5)	8 (16)
No idea	15 (25.4)	0 (0)
The sharp instruments are essential for reducing excessive forces during instrumentation		
Agree	34 (57.6)	27 (54)
Disagree	8 (13.6)	8 (16)
Maybe	3 (5.1)	15 (30)

(Contd...)

Table 1: (Continued)

Questions	Final year (%)	Interns (%)
No idea	5 (8.5)	0 (0)
Is the precise angulation of the hand instruments and the accessibility to the operating area relevant?		
Agree	40 (67.8)	14 (28)
Disagree	7 (11.9)	20 (40)
Maybe	3 (5.1)	15 (30)
No idea	0 (0)	1 (2)
Poor fitting gloves can cause pain in the hands		
Agree	16 (27.1)	14 (28)
Disagree	16 (27.1)	5 (10)
Maybe	16 (27.1)	16 (32)
No idea	2 (3.4)	15 (30)
Proper operating light position is not a critical factor in producing an even, shadow-free illumination		
Agree	43 (72.9)	6 (12)
Disagree	5 (8.5)	12 (24)
Maybe	2 (3.4)	31 (62)
No idea	0 (0)	1 (2)
Surgical loupes help the operator to maintain a neutral position while increasing the visual acuity and diagnostic ability		
Agree	8 (13.6)	22 (44)
Disagree	25 (42.4)	23 (46)
Maybe	17 (28.8)	3 (6)
No idea	0 (0)	2 (4)
Innovative ergonomic extraction kits like Benex have made extraction procedures atraumatic, easy, and effective		
Agree	9 (15.3)	15 (30)
Disagree	16 (27.1)	20 (40)
Maybe	25 (42.4)	7 (14)
No idea	0 (0)	8 (16)
Lasers give us an ergonomic edge by reducing the treatment time and increasing patient as well as operator comfort		
Agree	41 (69.5)	22 (44)
Disagree	4 (6.8)	5 (10)
Maybe	5 (8.5)	16 (32)
No idea	0 (0)	7 (14)
Should the dental surgeon take microbreaks to reduce excessive muscle fatigue?		
Agree	42 (71.2)	6 (12)

(Contd...)

Table 1: (Continued)

Questions	Final year (%)	Interns (%)
Disagree	2 (3.4)	29 (58)
Maybe	6 (10.2)	8 (16)
No idea	0 (0)	7 (14)
Have you ever used chair side exercises in your clinical work?		
Agree	27 (45.8)	10 (20)
Disagree	6 (10.2)	25 (50)
Maybe	14 (23.7)	7 (14)
No idea	3 (5.1)	8 (16)
Emphasis about equipment ergonomics is less in the present dental curriculum		
Agree	11 (18.6)	21 (42)
Disagree	15 (25.4)	12 (24)
Maybe	20 (33.9)	15 (30)
No idea	4 (6.8)	2 (4)
It should be included as a separate entity in the syllabus before the students enter the clinic		
Agree	50 (100)	31 (62)
Disagree	0 (0)	11 (22)
Maybe	0 (0)	1 (2)
No idea	0 (0)	7 (14)
Improper equipment ergonomics and its related musculoskeletal problems should be properly emphasized in the curriculum		
Agree	47 (79.7)	7 (14)
Disagree	2 (3.4)	5 (10)
Maybe	1 (1.7)	7 (14)
No idea	0 (0)	31 (62)

community treating patients with good knowledge of the subject, this specific student population was chosen, as they have almost finished undergraduate level university examinations prior and are destined to design the future of dentistry.

In the current study, 50 undergraduate final year students and 50 interns were selected randomly. On asking whether ergonomic principles apply only to clinician's position, but not to equipment's, only 15.3% of the final year students agreed while 39% of the interns agreed for the same question.

On asking whether they consider musculoskeletal problems are not related to wrong equipment ergonomics, 61% of final year students disagreed while 28% of the interns which shows that they are updated about these problems related to use of correct dental equipment.

In offering adequate dental care, the dental chair is one of the most fundamental of all services. Early in student preparation, Haddad *et al.* suggested implementing ergonomically built chairs before creating inappropriate postures.^[7] This research offers an

insight into this, as only 8% of interns were conscious that the height of the chair must be changed such that the mouth of the patient could be at the elbow level of the operator.^[8] Furthermore, about 62% of interns mentioned that they have “No idea” regarding this. When asked, 61% of the final year students and 78% of the interns agreed that dental chair ergonomics is needed to maintain operator’s neutral position.

On asking whether the operator chair height be adjusted so that hips are slightly higher than knees, 69.5% of the final year students agreed while surprisingly only 8% of the interns agreed to this question.

Conceivably, the operator’s stool is the most elusive and misunderstood unit. Dentists who sit in a chair for more than 80–100% of the day, combined with weak lumbar support and insufficient adaptability, have a greater risk of developing lower back pain.^[6] In our study, 20.3% of the final year students and 20% of interns admitted that during stool change they were not sure of the ideal alignment of the operator’s knees to the hips.

Surprisingly, 72% of interns agreed that light weight instruments do not help to reduce muscle workload.

Gerwatowski *et al.* stressed that it is crucial to reducing tension to keep the working edges sharp.^[9] The respondents in our study exhibited satisfactory knowledge regarding hand instruments ergonomics and about 57.6% final year and 54% of interns were aware that sharpness and angulation of instruments are important for accessibility.

The use of gloves of appropriate size and fit, and its effect on hand pain, has yet to be studied, and gloves have been implicitly cited as an imminent outcome of carpal tunnel syndrome.^[10-12]

In this report, when queried about equipment needing ergonomic considerations, oddly, very few respondents (28%) thought gloves required ergonomic designs. In this respect, this indicated an uncertain reaction from the dental practitioners.

In 2004, Martin *et al.* reported that the illumination and surgical magnification devices are good partners in preserving the operator’s proper ergonomic role with decreased tension.^[13] It can be calibrated such that its strength is marginally higher than that of the overhead operating light to minimize eye pressure. However, surprisingly in this study, overall 12% of interns gave incorrect response, while 72.9% of final year students gave correct response demonstrating lack of awareness regarding the same among interns.

On asking whether they think lasers give us an ergonomic edge by reducing the treatment time and increasing patient as well as operator comfort, 69.5% and 44% of final year students and interns agreed, respectively.

Half of the interns (50%) never used any chair side exercises in their clinical work whereas 45.8% of the final year students agreed to do chair side exercises.

All the final year students (100%) agreed that ergonomics should be included as a separate entity in the syllabus before the students enter the clinic, while only 62% of interns agreed for the same.

The participants lacked a proper understanding of EE and the newer developments in traditional instruments in the current cross-sectional research. Since the vital element of EE has not been added as part of India’s dental curriculum, directly or indirectly, including basics, initiatives through lectures and seminars, and a

curative and diagnostic method, organization has been included. Within the limitations of this study, we suggest improvising the scenario of an acquaintance of EE in the dental curriculum.

We are frequently ignorant of the habits that cause us stress and this impedes with our ability to respond positively to such stimuli in our daily lives. This fundamental problem could be addressed effectively by means such as self-awareness programs (Feldenkrais Method^[14] and Alexander technique),^[15] behavioral shaping (relaxation and cognitive training), exercise therapy (proprioceptive neuromuscular facilitation,^[16] aerobic exercises, and Bruegger’s exercises), and interventional strategies such as Kinesio taping.^[17] Alexander technique has been recognized as a unique method of mindbody reeducation and recovers postural coordination by means of conscious developments.^[18] Karatas *et al.* found that Kinesio tape was successful in treating MSI and enhancing surgeon functional performance.^[19] In conjunction with fitness activity and awareness services with their complex malleability, systematic understanding and clinical implementation of EE, supports the hypothesis that it is possible to reduce MSI by restraining muscle spasm, strengthening postural muscles, refining coordination, improving flexibility, and decompressing the spine.

As this study was concerned with the dental interns and final year UGs of Bareilly, Uttar Pradesh, India, additional longitudinal surveys must be carried out to thoroughly assess the expertise of the class of dental students.

Few recommendations made by the authors include:

1. Training of dental students and practitioners in EE vital practices and regularly reviewing their success and development
2. Conducting EE CDE workshops for clinicians to stress its significance in practice and even frequent monitoring for symptoms linked and MSIs to provide measures to avoid, diagnose early, and quickly treat
3. To support this essential area, create money and recommendations for the production and availability of EE friendly dental products and collect grants
4. The formulation of EE interpolations (chair reformatting, magnification and lighting, microbreaks of operation, and systemic improvements in health advancement activities) and the academic appraisal of student performance will help ensure that EE is conducted prudently
5. Establishing a nationalized inspection agency to avoid non-ergonomic dental equipment from being made, marketed, and distributed.

CONCLUSION

In dental practice, ergonomics concepts can be adopted by the correct location of the patient chair, instrument/tool design, needs of the workstation, position of the operator chair, stance, and position of the dental practitioner. The importance of the use of magnification devices such as dental loupes and microscopes should be reinforced at student training level as it influences the posture of the dentist which eventually becomes a habit. Another important aspect is the practice of four- and six-hand dentistry to minimize the

stress on the practitioner. Through educational programs, seminars, etc., dental practitioners should be trained at student level on the advantages and implementation of best ergonomic practices to promote smooth dental practice and avoid occupational hazards.

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