REVISTA DA ABENO
Associação Brasileira de Ensino Odontológico
https://revabeno.emnuvens.com.br ISSN 2595 0274

Ergonomic posture profile of dental students at a university in southern Brazil

Gilmar da Rosa Souza Júnior[1]
0000-0003-3596-3096

Greycianne Carvalho Borges[1]
0009-0002-0183-7796

Jean Marlon Machado[2]
0000-0001-5727-4262

Daniela Peressoni Vieira Schuldt[3]
0000-0002-2289-2690

Daniela de Rossi Figueiredo[1]
0000-0002-7817-2027

[1]Universidade do Sul de Santa Catarina (UniSul), Palhoça, Santa Catarina, Brasil.
[2]Universidade do Estado de Santa Catarina (UDESC), Florianópolis, Santa Catarina, Brasil.
[3]Nova Southeastern University (NSU), Fort Lauderdale, Florida, United States of America.

Correspondence:
Gilmar da Rosa Souza Júnior
E-mail: gilmarsctb@gmail.com

Received: Feb 02, 2023
Approved: Apr 03. 2023
Last revision: Sept 16, 2024

Abstract Dentistry has been recognized as a profession vulnerable to occupational risks, often associated with some form of physical impairment. Dental surgeons are prone to developing work-related musculoskeletal disorders, which result from improper body positioning during clinical practice. These disorders can worsen, leading to a temporary or, in severe cases, early cessation of professional activities. This study aimed to evaluate the ergonomic posture profile of dental students during clinical sessions at the Dentistry Clinic of the University of Southern Santa Catarina, Pedra Branca Campus. An observational, cross-sectional study with an intentional and non-probabilistic sample was conducted. It was observed that the majority (n=27, 75%) of the 36 evaluated students exhibited partially adequate body posture; none of them met the criteria for completely inadequate posture, and only 9 (25%) had fully adequate body posture. Among the postural characteristics evaluated, students positioned themselves more appropriately regarding trunk inclination (n=31, 86.11%) and foot support (n=30, 83.33%). The most frequent inadequate postural characteristics were forearm inclination (n=18, 50.00%) and head inclination (n=15, 41.67%). Additionally, no improvement in body posture was observed among students from more advanced academic years. In conclusion, the overall body posture of the evaluated students was partially adequate.
Descriptors: Students, Dental. Ergonomics. Posture.

Perfil de postura ergonómica de estudiantes de Odontología en una universidad del Sur de Brasil
Resumen La odontología ha sido considerada una profesión vulnerable a riesgos laborales, a menudo asociados con alguna discapacidad física. Los cirujanos dentistas están sujetos a desarrollar trastornos musculoesqueléticos relacionados con el trabajo, que son una consecuencia de la posición incorrecta de las estructuras corporales durante la atención clínica. Estos trastornos pueden empeorar y llevar al abandono de la profesión y, en casos más graves, al abandono prematuro. El presente estudio tuvo como objetivo evaluar el perfil postural ergonómico de los estudiantes de odontología durante la atención en la clínica de odontología de la Universidade do Sul de Santa Catarina, Campus Pedra Branca. Se realizó un estudio observacional transversal, con muestreo intencional y no probabilístico. Se observó que la mayoría (n=27, 75%) de los 36 estudiantes evaluados presentaron una postura corporal parcialmente adecuada, ninguno de ellos cumplió con los criterios para una postura completamente inadecuada, y solo 9 (25%) tenían una postura corporal completamente adecuada. Entre las características posturales evaluadas, los estudiantes se posicionaron de manera más adecuada en relación con la inclinación del tronco (n=31, 86,11%) y el apoyo de los pies (n=30, 83,33%). Las características posturales inadecuadas más frecuentes fueron la inclinación del antebrazo (n=18, 50,00%) y la inclinación de la cabeza (n=15, 41,67%). También se observó que no hubo mejora en la postura corporal de los estudiantes en años académicos más avanzados. En conclusión, la postura corporal general de los estudiantes evaluados fue parcialmente adecuada.
Descriptores: Estudiantes de Odontología. Ergonomía. Postura.

Perfil da postura ergonômica de acadêmicos de Odontologia de uma universidade no sul do Brasil
Resumo A Odontologia tem sido considerada uma profissão vulnerável a riscos ocupacionais, frequentemente associados a algum comprometimento físico. Os cirurgiões-dentistas estão sujeitos a desenvolver distúrbios osteomusculares

relacionados ao trabalho, que representam uma consequência do posicionamento incorreto das estruturas do corpo durante o atendimento clínico. Estas podem se agravar e levar ao afastamento do exercício da profissão e, em casos mais graves, ao abandono precoce. O presente estudo teve por objetivo avaliar o perfil da postura ergonômica de acadêmicos de Odontologia durante atendimento na clínica de Odontologia da Universidade do Sul de Santa Catarina, Campus Pedra Branca. Foi realizado um estudo observacional de caráter transversal, com amostra intencional e não-probabilística. Observou-se que a maioria (n=27, 75%) dos 36 estudantes avaliados apresentaram postura corporal parcialmente adequada, nenhum deles atendeu aos critérios para postura totalmente inadequada e apenas 9 (25%) estavam com uma postura corporal totalmente adequada. Dentre as caracteristicas posturais avaliadas os estudantes se posicionaram mais adequadamente em relação à inclinação do tronco (n=31, 86,11%) e ao apoio dos pés (n=30, 83,33%). As características posturais inadequadas mais frequentes foram a inclinação do antebraço (n=18, 50,00%) e da cabeça (n=15, 41,67%). Observou-se também que não houve uma melhora na postura corporal dos acadêmicos dos anos letivos mais avançados. Em conclusão, a postura corporal geral dos acadêmicos avaliados foi parcialmente adequada.
Descritores: Estudantes de Odontologia. Ergonomia. Postura.

INTRODUCTION

Ergonomics in Dentistry has contributed to maintaining the occupational health of dental surgeons by preserving the balance between the technologies available in the dental office, the professional's musculoskeletal system, and the operational field[1]. However, Dentistry has been considered a profession vulnerable to occupational risks, frequently associated with some form of physical impairment[2].

Dental surgeons and dental students are prone to developing work-related musculoskeletal disorders (WRMSDs), which are a consequence of improper body positioning during clinical procedures[3]. These injuries can worsen, leading to temporary removal from the profession and, in severe cases, premature abandonment[2].

The most frequently reported disorders among DSs involve the spine, shoulders, and hand-wrist, which can result in lower back pain, cervical pain, cervicobrachial pain, shoulder tendinitis, De Quervain tenosynovitis, and Guyon canal syndrome[4]. The most common treatments for WRMSDs are anti-inflammatory medications, rest, immobilization, and physical therapy[5]. These issues could be avoided if professionals/students adhered to ergonomic and anthropometric factors, adopted correct posture, and slept adequately during work[5].

Self-recognition and identification of WRMSDs by professionals is the first step towards prevention. Adopting a healthy lifestyle is an important aspect of education[6]. Undergraduate courses should play a fundamental role, which should teach proper posture and appropriate exercises to prevent these types of disorders, especially for future dental professionals[6]. Observational studies on the body posture of students are crucial for WRMSD prevention, as ergonomics plays an essential role in clinical dental practice and should be adopted from the beginning of the career. Therefore, this study aimed to evaluate the ergonomic posture of dental students at the University of Southern Santa Catarina, Pedra Branca Campus, during clinical attendance.

METHOD

An observational, cross-sectional study was conducted, and approved by the Research Ethics Committee with Human Beings of the University of Southern Santa Catarina (register: 5.041.092).

The sample was intentional and non-probabilistic. The study involved 36 dental students enrolled in Integrated Clinic Internships, with regular enrollment between the 3rd and 5th academic years. Students who performed procedures while standing and those with reported musculoskeletal dysfunctions that compromised their body posture were excluded.

Students were recruited through personal invitations. Those who voluntarily agreed to participate signed the Informed Consent Form and completed a medical history form containing demographic data and their academic year. Data collection took place at the Dentistry Clinic of the University of Southern Santa Catarina, Pedra Branca Campus, during clinical attendance in the integrated clinic of the Dentistry program.

For ergonomic assessment, a cell phone with a 12-megapixel camera was used, positioned approximately one meter high and one meter away from the dental chair, perpendicular to the student's left sagittal plane. A trained evaluator photographed the student once they maintained a consistent position for at least one minute during the ongoing dental procedure. Subsequently, the photograph was exported to Kinovea software v. 0.9.5 (http://www.kinovea.org/) for virtual reconstruction of body segments and student's postural characteristics evaluation. Five postural characteristics in the sagittal plane were assessed, based on the description of healthy posture characteristics by Naressi et al (2013). Each characteristic was classified as either adequate or inadequate according to the criteria shown in Figure 1.

Example	Characteristics	Adequate Pattern	Inadequate Pattern
	1. Trunk Inclination: The angle formed between the trunk and the vertical plane.	≤10°	> 10°
	2. Head Inclination: The angle formed between the neck and the vertical plane.	≤ 25°	> 25°
	3. Forearm Inclination: The angle formed between the forearm and the horizontal plane.	Entre 10° e 25°	< 10° e > 25°
	4. Knee Angle: The angle formed between the lower leg and the thigh segments.	≥ 110°	< 110°
	5. Foot-to-Floor Relationship: The alignment and contact of the feet with the ground.	Fully supported	Partially or not supported.

Figure 1. Example of Measurements of Postural Characteristics in Kinovea Software, postural characteristics and corresponding parameters**.**

For each participating student, a general classification of body posture during dental treatment was established based on the observed postural characteristics. Students with all five postural characteristics deemed adequate received a general classification of "fully adequate." Students with none of the postural characteristics deemed adequate received a general classification of "fully inadequate." Students with one to four of the postural characteristics deemed adequate received a general classification of "partially adequate."

The collected data were analyzed using descriptive statistics (relative and absolute frequencies). To assess the association between students' posture and their current academic year, the chi-square test was employed. For variables with counts less than 5, Fisher's exact test was used. All tests were conducted using SPSS software (IBM, Armonk, NY,

USA), with a significance level set at p ≤ 0.05.

RESULTS

According to the general classification of students' body posture, none met the criteria for "fully inadequate" posture. The majority (75.00%) presented a "partially adequate" posture, and only 25.00% had a "fully adequate" body posture (Table 1).

Among the evaluated postural characteristics, students were better positioned concerning trunk inclination (86.11%) and foot support (83.33%). The most frequently observed inadequate postural characteristics were forearm inclination (50.00%) and head inclination (41.67%) (Table 2).

Table 1. General classification of body posture.

Classification	n (%)
Fully adequate	9 (25.00)
Partially adequate	27 (75.00)
Fully inadequate	-

Table 2. Postural characteristics of students.

Variables	n (%)
Trunk inclination	
Adequate	31 (86.11)
Inadequate	5 (13.89)
Head inclination	
Adequate	21 (58.33)
Inadequate	15 (41.67)
Forearm inclination	
Adequate	18 (50.00)
Inadequate	18 (50.00)
Knee angle	
Adequate	25 (68.44)
Inadequate	11 (30.56)
Foot-to-floor	
Adequate	30 (83.33)
Inadequate	6 (16.67)

Fisher's exact test revealed an association between the academic year and foot posture ($p < 0.05$), with adequate posture in 100% of third-year students, 56% of fourth-year students, and 85% of fifth-year students. An association was also found between the academic year and forearm posture ($p < 0.05$), with adequate posture in 42.86% of third-year students, 22.22% of fourth-year students, and 76.92% of fifth-year students. It was observed that fourth-year students exhibited more inadequate positioning regarding forearm inclination, foot position, knee angle, and head inclination. Fifth-year students were more inadequately positioned concerning trunk inclination (Table 3).

Table 3. Association between postural characteristics and academic year.

Variables	3° year n (%)	4° year n (%)	5° year n (%)	p-value
Trunk inclination				
Adequate	12 (85.71)	8 (80.00)	11 (84.62)	1.000
Inadequate	2 (14.29)	1 (20.00)	2 (15.38)	
Head inclination				
Adequate	9 (64.29)	4 (44.44)	8 (61.54)	0.690
Inadequate	5 (35.71)	5 (55.56)	5 (38.46)	
Forearm inclination				
Adequate	6 (42.86)	2 (22.22)	10 (76.92)	0.041
Inadequate	8 (57.14)	7 (77.78)	3 (23.08)	
Knee angle				
Adequate	10 (71.43)	5 (55.56)	10 (76.92)	0.591
Inadequate	4 (28.57)	4 (44.44)	3 (23.08)	
Foot-to-floor				
Adequate	14 (100.00)	5 (55.56)	11 (84.62)	0.009
Inadequate	-	4 (44.44)	2 (15.38)	

DISCUSSÃO

This study observed that most students were classified with a generally "partially adequate" body posture. When postural characteristics were observed individually, students exhibited greater difficulty maintaining an adequate neck and forearm posture. Previous studies have demonstrated that dental professionals and students predominantly exhibit generally inadequate body posture[4,8,9].

Dental surgeons, due to the complex and skilled nature of their work, as well as the prolonged awkward postures they adopt to perform their duties, are among the most susceptible professionals to work-related musculoskeletal disorders (WRMSDs)[3]. Dental students are also susceptible to developing WRMSDs[6].

The literature indicates that most cases of WRMSDs result from repetitive movements or maintaining the same position for extended periods[10]. Neck inclination and rotation, forward flexion with loss of cervical and lumbar lordosis, and elevated arms working in prolonged static isometric and eccentric contraction are primary risk factors for WRMSDs[11].

Most clinicians and students frequently report discomfort, unease, and reduced strength for prolonged work[6]. A recent study involving 26 dental students showed that the main regions prone to pain and discomfort after dental procedures were the back-lumbar spine (42.2%) and neck-cervical (61.4%)[12]. In the present study, 41.67% of students exhibited inadequate head inclination during procedures and 13.89% exhibited inadequate trunk inclination. Long-term inadequate positioning leads to severe consequences. A study by Bruers *et al.* (2017)[13] in the Netherlands reported that 95% of dental students experienced muscle and joint pain in the past 12 months. Khan and Chew (2013)[14] in Malaysia observed that 93% of dental students with more years of clinical training developed WRMSDs. A longitudinal study by Hayes, Smith, and Taylor (2012)[15] in Australia found that WRMSD symptoms in the neck, shoulders, and wrists progressively worsened with years of clinical training, with a sharp increase in the final year.

The initial development of symptoms raises concerns for future dental professionals, especially as they have not yet fully engaged in the rigors of full-time clinical practice[16]. A higher percentage of WRMSDs is observed among dental professionals working more than 40 hours per week compared to those working between 12 and 20 hours per week[3].

Additionally, some authors highlight the importance of both the dental chair position, which should be adjusted according to the dentist's height, and the use of proper lighting[4]. Chair elevation affects arm posture, a major difficulty observed in this study.

No improvement in body posture was observed among students in more advanced academic years. There is a clear need for ergonomic training among dental students, regardless of their academic year.

Several limitations of this study should be mentioned. First, joint angles were measured only through visual analysis, without anatomical markers. This may have increased measurement error, but it was a strategy used to prevent students from altering their posture due to participation in the study, and all measurements were conducted by a trained researcher. Second, only the left side was analyzed. Analyzing the right side could yield different results as the two arms perform different functions during procedures. Third, the limited number of participants prevented statistical analyses and inferences regarding the results. Thus, future studies should involve a larger number of students.

CONCLUSION

The overall body posture of the surveyed students was partially adequate. Among the evaluated postural characteristics, students were better positioned regarding trunk inclination and foot support. The most frequent inadequate postural characteristics were forearm and head inclination. No improvement in body posture was observed among students in more advanced academic years.

REFERENCES

1. Garcia PPNS, Gottardello ACA, Wajngarten D, Presoto CD, Campos JADB. Ergonomics in dentistry: experiences of the practice by dental students. Eur J Dent Educ [Internet]. 2017;21(3):175-179. doi: https://doi.org/10.1111/eje.12197
2. Santos M, Guerreiro M, Hamada A, Santos K, Luciano L. Percepção sobre ergonomia pelos acadêmicos de odontologia de uma faculdade privada de Imperatriz-MA. Rev Odontol Araçatuba [Internet]. 2017;19-26. http://dx.doi.org/10.15600/2238-1236/fol.v32n1-2p39-48
3. Gandolfi MG, Zamparini F, Spinelli A, Risi A, Prati C. Musculoskeletal Disorders among Italian Dentists and Dental Hygienists. Int J Environ Res Public Health [Internet]. 2021;18(5):1–20. doi: https://doi.org/10.3390/ijerph18052705
4. Sio S, Traversini V, Rinaldo F, Colasanti V, Buomprisco G, Perri R, et al. Ergonomic risk and preventive measures of musculoskeletal disorders in the dentistry environment: an umbrella review. PeerJ [Internet]. 2018;6(1). doi: https://doi.org/10.7717/peerj.4154
5. Araújo MA, Paula MVQ. LER/DORT: um grave problema de saúde pública que acomete os cirurgiões-dentistas. Rev APS [Internet]. 2003;6(2):87–93.
6. Kumar P, Sahitya S, Penmetsa G, Supraja S, Kengadaran S, Chaitanya A. Assessment of knowledge, attitude, and practice related to ergonomics among the students of three different dental schools in India: An original research. J Educ Health Promot [Internet]. 2020;9(1). doi: https://doi.org/10.4103/jehp.jehp_208_20
7. Naressi W, Orenha E, Naressi S. Ergonomia e biossegurança em Odontologia. São Paulo: Artes Médicas; 2013.
8. Oliveira LQ, Ferreira MBC. Ergonomia na prática odontológica. J Oral Investig [Internet]. 2017;6(1):15–28. doi: https://doi.org/10.18256/2238-510X/j.oralinvestigations.v6n1p15-28
9. Garcia PPNS, Campos JADB, Zuanon ÂCC. Posturas de trabalho de alunos no atendimento odontológico de bebês. Rev Odontol da UNESP [Internet]. 2008;37(3):253–259.
10. Uppada UK, Susmitha M, Hussaini SWU, Virk I, Yadav TG, Khader MA. Ergonomics among dentists in the states of Telangana and Andhra Pradesh. Natl J Maxillofac Surg [Internet]. 2020;11(2):253. doi: https://doi.org/10.4103/njms.NJMS_33_20
11. Moodley R, Naidoo S, Wyk VJ. The prevalence of occupational health-related problems in dentistry: A review of the literature. J Occup Health [Internet]. 2018;60(2):111. doi: https://doi.org/10.1539/joh.17-0188-RA
12. Mazzucco A, Souza LA. Posturas adotadas durante os procedimentos odontológicos e os seus impactos biomecânicos. Inova Saude [Internet]. 2017;6(1):226. doi: https://doi.org/10.18616/is.v6i1.2488
13. Bruers JJM B, Trommelen LECM, Hawi P, Brand HS. Musculoskeletal disorders among dentists and dental students in the Netherlands. Ned Tijdschr Tandheelkd [Internet]. 2017;124(11):581–587. doi: https://doi.org/10.5177/ntvt.2017.11.17128

14. Khan SA, Yee Chew K. Effect of working characteristics and taught ergonomics on the prevalence of musculoskeletal disorders amongst dental students. BMC Musculoskelet Disord [Internet]. 2013;14(1):1–8. doi: https://doi.org/10.1186/1471-2474-14-118
15. Hayes MJ, Taylor JA, Smith DR. Musculoskeletal disorders in a 3 year longitudinal cohort of dental hygiene students. Int J Dent Hyg[Internet]. 2012;10(4):265–269. doi: http://dx.doi.org/10.1111/j.1601-5037.2011.00536.x
16. Mulimani P, Hoe V, Hayes M, Idiculla Jj, Abas A, Karanth L. Ergonomic interventions for preventing musculoskeletal disorders in dental care practitioners. Cochrane Database Syst Rev [Internet]. 2018;(10):1-38. doi: https://doi.org/10.1002/14651858.CD011261.pub2

Conflict of Interest: The authors declare no conflict of interest.

Funding: No funding to declare.

Acknowledgments: To the Institutional Program of Scientific Initiation Scholarships (PIBIC-CNPq) of the University of Southern Santa Catarina.

Authors' Contributions: Study conception and planning: GRSJ, GCB, DRF, DPVS. Data collection, analysis, and interpretation: GRSJ, GCB, DRF, JMM, DPVS. Manuscript drafting or revision: GRSJ, DRF. Approval of the final version: GRSJ, GCB, DPVS, JMM, DRF. Public responsibility for the content of the article: GRSJ, GCB, DPVS, JMM, DRF.