British Journal of Education, Society & Behavioural Science
15(4): 1-6, 2016, Article no.BJESBS.25838
ISSN: 2278-0998

SCIENCEDOMAIN *international*
www.sciencedomain.org

Risk Factors for the Development of Musculoskeletal Disorders in Dental Work

Cristina Dupim Presoto[1] and Patrícia Petromilli Nordi Sasso Garcia[2*]

[1]Department of Social Dentistry, Araraquara Dental School, UNESP – Univ. Estadual Paulista, Araraquara, São Paulo, Brazil.
[2]Ergonomics in Dentistry, Department of Social Dentistry, Araraquara Dental School, UNESP – Univ. Estadual Paulista, Araraquara, São Paulo, Brazil.

Authors' contributions

This work was carried out in collaboration between both authors. Author PPNSG designed the study, wrote the protocol and supervised the work. Authors CDP and PPNSG managed the literature search. Author CDP wrote the first draft of the manuscript. Author PPNSG edited the manuscript. Both authors read and approved the final manuscript.

Article Information

DOI: 10.9734/BJESBS/2016/25838
Editor(s):
(1) Chan Shen, Department of Biostatistics, University of Texas, USA.
Reviewers:
(1) Timothy Hui, Loma Linda University, California, USA.
(2) Olufemi O. Oyewole, Olabisi Onabanjo University, Nigeria.
Complete Peer review History: http://sciencedomain.org/review-history/14295

Mini-review Article

Received 22nd March 2016
Accepted 13th April 2016
Published 22nd April 2016

ABSTRACT

Background: The prevalence of Work-related Musculoskeletal Disorders (WMSDs) among dental professionals is high and may interfere with individuals' functional capacity of both from a physical and emotional standpoint.
Aim: To review the literature regarding the work-related risk factors that may contribute to the development of musculoskeletal symptoms in dental professionals.
Methods: The literature review was carried out in Science Direct, *SCIELO*, Pub Med*, LILACS* and *MEDLINE* databases from 2002 to 2015. The research was on work-related musculoskeletal disorders in dentistry, specifically risk factors. The main keywords used were "work-related musculoskeletal symptoms in Dentistry", "Ergonomics in Dentistry", "risk factors," "musculoskeletal symptoms" and "Dentistry".
Results: Fifty three manuscripts were collected and were included only articles available in its

**Corresponding author: E-mail: psgarcia@foar.unesp.br;*

entirety, in English, focused on students and dental professionals (n=26). The most frequently reported factors were static posture, repetitive movements, inclination and rotation of the head, neck and trunk, presence of psychological factors, use of muscle strength, pinch-grip force, excessive force to arrest, long time in a seated position, without breaks and incorrect positioning of the patient in dental chair.

Conclusions: It can be concluded that the development of musculoskeletal disorders in Dentistry has multifactorial cause and the main risk sources are related to biomechanical, environmental/external and organizational factors.

Keywords: Musculoskeletal diseases; risk factors; dentists; students.

1. INTRODUCTION

Work-related Musculoskeletal Disorders (WMSDs) correspond to a range of inflammatory and degenerative diseases that affect the musculoskeletal system [1,2]. It leads to subjective complaints such as pain, tingling and numbness [3]. It often results in decreased productivity, performance and job satisfaction, increased anxiety and stress, lower quality of life of the worker, absences for long periods, early retirement and indemnities [4].

As well as professionals from different fields, dentists and dental students are also exposed to occupational health problems. The prevalence of WMSDs among dentists and other dental professionals is high [5] and is manifested mainly as pain in the neck, shoulders [4,5-10], hands, wrists and lower back [4,6,8,10]. It may interfere with individuals' functional capacity of both from a physical and emotional standpoint.

In order to decrease the WMSDs' prevalence among dental professionals, the first step should be to identify the main risk factors to which these professionals are exposed in their work environment, so that strategies can be implemented to complete removal of the factor, when it is possible, or modification of the workstation to decrease its consequences.

Thus, this study aimed to review the literature regarding the work-related risk factors that may contribute to the development of musculoskeletal symptoms in dental professionals in order to verify the most frequent and that cause further damage to the professionals.

2. MATERIALS AND METHODS

The literature review was carried out in databases such as Science Direct, SCIELO (Scientific Electronic Library Online), Pub Med, LILACS (Latin American and Caribbean Health Sciences) and MEDLINE (National Library of Medicine, USA) from 2002 to 2015.

The research was on work-related musculoskeletal disorders in dentistry, specifically the risk factors. The main keywords used were "work-related musculoskeletal symptoms in Dentistry", "Ergonomics in Dentistry", "risk factors," "musculoskeletal symptoms" and "Dentistry".

Fifty three manuscripts were retrieved and were included only the manuscripts available in its entirety, in English, which address the major risk factors for dental professionals (n=26).

3. RESULTS

The papers evaluated are presented in Chart 1.

4. DISCUSSION

In the present study, it is verified that the cause of musculoskeletal disorders in Dentistry is, most often, multifactorial. It could be observed in the literature review (Chart 1) that the most reported risk factors were static posture, performing repetitive movements, inclination and rotation of the head, neck and trunk to one side or forward, presence of psychological disorders, use of muscle strength, pinch-grasp force, excessive force to arrest, long time in a seated position, without breaks, instruments and equipments not ergonomic and restrict work area.

Static postures adopted by dentists require that more than 50% of muscles contract to keep the body motionless, while resisting to the gravity [11]. According to Rafie et al. [5], static contractions lead to the accumulation of lactic acid, reducing oxygen levels, fatigue and pain. Valachi and Valachi [11] also emphasize the relationship between prolonged static muscle contractions and fatigue, muscle imbalance,

Chart 1. Studies about work factors that may contribute to developing musculoskeletal symptoms in dental professionals. Araraquara, Brazil, 2015

Work factors that may contribute to musculoskeletal symptoms	Authors
Prolonged periods of static muscular activity / static posture (isometric muscle contraction)	Biswas et al. [4], de Carvalho et al. [6], Kanteshwari et al. [7], Bedi et al. [8], Hodacova et al. [9], Park et al. [10], Valachi and Valachi [11], Valachi and Valachi [12], Gandavadi et al. [13], Cherniack et al. [14], Morse et al. [15], Ellapen et al. [16], Prasad et al. [17], Ayatollahi et al. [18], Books and Klemm [19], Garcia et al. [20], Haddad et al. [21], Kumar et al. [22], Corrocher et al. [23], Golchha et al. [24]
Repetitive movements	Punnett et al. [1], Biswas et al. [4], de Carvalho et al. [6], Kanteshwari et al. [7], Bedi et al. [8], Valachi and Valachi [11], Morse et al. [15], Prasad et al. [17], Kumar et al. [22], Corrocher et al. [23], Rising et al. [25], Gambhir et al. [26], Alghadir et al. [27]
Constant inclination and rotation of the head, neck and trunk to one side or to front	Punnett et al. [1], Biswas et al. [4], de Carvalho et al. [6], Kanteshwari et al. [7], Bedi et al. [8], Valachi and Valachi [11], Valachi and Valacchi [12], Gandavadi et al. [13], Ellapen et al. [16], Prasad et al. [17], Ayatollahi et al. [18], Books and Klemm [19], Kumar et al. [22], Golchha et al. [24], Gambhir et al. [26]
Psychological disorders (stress, tension, depression, emotional exhaustion and depersonalization)	Biswas et al. [4], Kanteshwari et al. [7], Bedi et al. [8], Hodacova et al. [9], Valachi and Valachi [11], Cherniack et al. [14], Morse et al. [15], Garcia et al. [20], Rising et al. [25], Horton et al. [28]
Use of muscle strength, pinch-grip force, excessive force to arrest	Punnett et al. [1], Biswas et al. [4], Morse et al. [15], Prasad et al. [17], Ayatollahi et al. [18], Kumar et al. [22], Alghadir et al. [27]
Long time in a seated position, work seated without lower back support, without breaks / work always in the same position, standing or sitting	de Carvalho et al. [6], Kanteshwari et al. [7], Bedi et al. [8], Hodacova et al. [9], Valachi and Valachi [11], Valachi and Valachi [12], Gandavadi et al. [13], Morse et al. [15], Ellapen et al. [16], Ayatollahi et al. [18], Books and Klemm [19], Garcia et al. [20], Haddad et al. [21], Corrocher et al. [23], Golchha et al. [24], Alghadir et al. [27], Thornton et al. [29]
Instruments (shape, size, weight, diameter and texture; manipulation's difficult, vibrating) and equipment not ergonomic and incorrectly positioned/ workstations inadequately designed	Punnett et al. [1], Biswas et al. [4], de Carvalho et al. [6], Kanteshwari et al. [7], Hodacova et al. [9], Park et al. [10], Cherniack et al. [14], Prasad et al. [17], Garcia et al. [20], Haddad et al. [21], Kumar et al. [22], Golchha et al. [24], Gambhir et al. [26], Alghadir et al. [27]
Restricted work area, difficulties with direct vision, visual request	Biswas et al. [4], Hodacova et al. [9], Gandavadi et al. [13], Morse et al. [15], Prasad et al. [17], Garcia et al. [20], Corrocher et al. [23], Horton et al. [28]

ischemia/necrosis, pain, protection's muscle contraction, nerve compression, disk degeneration of the spine and consequently musculoskeletal disorder. This static force of musculature often occurs when professionals work long periods without pause, in search of maximum efficiency [11].

Repetitive movements [1,4,6-8,11,15,17,22,23, 25-27] cause excessive tension in the muscles, decreased circulation and tear on the joint structures that can generate compression on the nerves and blood vessels [17]. These movements are identified as causing occupational factors of carpal tunnel syndrome, median nerve dysfunction and decreased tactile perception among dentists. It was found in the literature that general dental practitioners are less susceptible to repetitive motion injuries [4] compared with endodontists [27], periodontists

and surgeons, due to repetitive motions involved in the work of these experts [4,11].

For the prevention of troubles related to static posture and repetitive movements, Valachi and Valachi [12] suggest frequent breaks during the workday to perform stretching exercises. According to the authors, the stretching provides several benefits to the professional, since it increases the blood flow to the muscles, rises the production of synovial fluid into the joint, reduces the formation of trigger points, promotes the maintenance of the motion's joint range, increases the nutrients' supply to the intervertebral disc, in addition to create a relaxation response in the nervous system and even warm the muscles to the work.

Inclination and rotation of the head, neck and trunk to one side or to front were also very much emphasized in the literature, and happen by the search for better visibility of the operative field [1,4,6-8,11-13,16-19,22,24,26]. Over time, this practice can make the muscles responsible for rotation become stronger and shorter on one side of the body, while the opposite muscles become weaker and elongated. The shortened muscles can become ischemic and painful asymmetric forces acting on the spine, causing misalignment thereof and decreased motion range in one direction relative to the other [11]. Additionally, if the vertebrae do not support adequately the vertebral column, the constant contraction of the muscles of the chest and upper cervical spine to support the weight of the head forward can cause Tension Neck Syndrome. The symptoms of this syndrome are mainly headache and chronic pain in the neck, shoulders and muscles, occasionally radiating into the arms [12]. Inclination and rotation of the head, neck and trunk to one side or to front occurs by incorrect positioning of the patient in dental chair [4,12,15,20,28-30]. Some authors suggest that when the patient is lying in the dental chair, the best viewing angle is achieved when it is kept a distance from 30 cm to 40 cm between the operator's eyes and the patient's mouth. Another point to observe is the properly patient positioned in the dental chair with the headrest positioned tilted downwards to work on the jaw and upwards on the maxilla.

The use of muscle strength, pinch-grip force and excessive force to arrest when performing procedures such as scaling are considered important risk factors [1,4,15,17,18,22,27]. Thus, if the manual instrument is ergonomically designed and lighter, there will be significant reduction in the development of musculoskeletal disorders [4,17], which is a low-cost alternative for the prevention of these occupational problems in dentistry.

In order that preventive actions are effective, the risks present in the dental professionals' workplace should be periodically evaluated so that possible mismatches are detected as early as possible. Nevertheless, there is none in literature an instrument specifically focused on dental area that allows such detection. Thus, the development of a specific instrument for this population would approach more accurately the risk factors in this area, allowing the development of strategies directed towards their prevention and control.

5. CONCLUSION

According to the methodology employed it is concluded that the development of musculoskeletal disorders in Dentistry has multifactorial cause and that the most frequently cited factors were static posture, repetitive movements, inclination and rotation of the head, neck and trunk to one side or to front, psychosocial factors, instruments' shape, lack of breaks and incorrect positioning of the patient in dental chair.

CONSENT

It is not applicable.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

REFERENCES

1. Punnett L, Wegman DH. Work-related musculoskeletal disorders: The epidemio-logic evidence and the debate. J Electromyogr Kinesiol. 2004;14(1):13-23.
2. Shimabukuro VG, Alexandre NM, Coluci MZ, Rosecrance JC, Gallani MC. Validity and reliability of a job factors questionnaire related to the work tasks of physical therapists. Int J Occup Saf Ergon. 2012;18(1):15-26.
3. Rosecrance JC, Ketchen KJ, Merlino LA, Anton DC, Cook TM. Test-retest reliability of a self-administered musculoskeletal

symptoms and job factors questionnaire used in ergonomics research. Appl Occup Environ Hyg. 2002;17(9):613-21.

4. Biswas R, Sachdev V, Jindal V, Ralhan S. Musculoskeletal disorders and ergonomic risk factors in dental practice. Ind J Dent Sci. 2012;4(1):70-4.
5. Rafie F, Zamani Jam A, Shahravan A, Raoof M, Eskandarizadeh A. Prevalence of upper extremity musculoskeletal disorders in dentists: Symptoms and risk factors. J Environ Public Health. 2015;2015:517346. DOI: 10.1155/2015/517346
6. de Carvalho MV, Soriano EP, de França Caldas A Jr, Campello RI, de Miranda HF, Cavalcanti FI. Work-related musculoskeletal disorders among Brazilian dental students. J Dent Educ. 2009;73(5):624-30.
7. Kanteshwari K, Sridhar R, Mishra AK, Shirahatti R, Maru R, Bhusari P. Correlation of awareness and practice of working postures with prevalence of musculoskeletal disorders among dental professionals. Gen Dent. 2011;59(6):476-83; quiz 484-5.
8. Bedi HS, Moon NJ, Bhatia V, Sidhu GK, Khan N. Evaluation of musculoskeletal disorders in dentists and application of DMAIC technique to improve the ergonomics at dental clinics and meta-analysis of literature. J Clin Diagn Res. 2015;9(6):ZC01-3.
   DOI: 10.7860/JCDR/2015/14041.6126
9. Hodacova L, Sustova Z, Cermakova E, Kapitan M, Smejkalova J. Self-reported risk factors related to the most frequent musculoskeletal complaints among Czech dentists. Ind Health. 2015;53(1):48-55.
   DOI: 10.2486/indhealth.2013-0141
10. Park HS, Kim J, Roh HL, Namkoong S. Analysis of the risk factors of musculoskeletal disease among dentists induced by work posture. J Phys Ther Sci. 2015;27(12):3651-4.
    DOI: 10.1589/jpts.27.3651
11. Valachi B, Valachi K. Preventing musculoskeletal disorders in clinical dentistry: Strategies to address the mechanisms leading to musculoskeletal disorders. J Am Dent Asso. 2003;134(12): 1604-12.
12. Valachi B, Valachi K. Mechanisms leading to musculoskeletal disorders in dentistry. J Am Dent Assoc. 2003;134(10):1344-50.
13. Gandavadi A, Ramsay JR, Burke FJ. Assessment of dental student posture in two seating conditions using RULA methodology - A pilot study. Br Dent J. 2007;203(10):601-5.
14. Cherniack MG, Dussetschleger J, Bjor B. Musculoskeletal disease and disability in dentists. Work. 2010;35(4):411-8.
    DOI: 10.3233/WOR-2010-0978
15. Morse T, Bruneau H, Dussetschleger J. Musculoskeletal disorders of the neck and shoulder in the dental professions. Work. 2010;35(4):419-29.
    DOI: 10.3233/WOR-2010-0979
16. Ellapen TJ, Narsigan S, van Herdeen HJ, Pillay K, Rugbeer N. Impact of poor dental ergonomical practice. SADJ. 2011;66(6): 272, 274-7.
17. Prasad V, Pratheeth G, Madhumietha A. Repetitive strain injuries and its incidence in practicing dentists. Int J Contemp Dent. 2011;2:6-11.
18. Ayatollahi J, Ayatollahi F, Ardekani AM, Bahrololoomi R, Ayatollahi J, Ayatollahi A, et al. Occupational hazards to dental staff. Dent Res J (Isfahan). 2012;9(1):2-7.
    DOI: 10.4103/1735-3327.92919
19. Books GJ, Klemm K. A unique approach to preventing back pain in the dental office. Work. 2012;42(2):299-306.
    DOI: 10.3233/WOR-2012-1354
20. Garcia PPNS, Pinelli C, Derceli JR, Campos JADB. Musculoskeletal disorders in upper limbs in dental students: exposure level to risk factors. Braz J Oral Sci. 2012;11(2):148-53.
21. Haddad O, Sanjari MA, Amirfazli A, Narimani R, Parnianpour M. Trapezius muscle activity in using ordinary and ergonomically designed dentistry chairs. Int J Occup Environ Med. 2012;3(2):76-83.
22. Kumar SP, Kumar V, Baliga M. Work-related musculoskeletal disorders among dental professionals: An evidence-based update. Indian J Dent Educ. 2012;5(1):5-12.
23. Corrocher PA, Presoto CD, Campos JA, Garcia PP. The association between restorative pre-clinical activities and musculoskeletal disorders. Eur J Dent Educ. 2014;18(3):142-6.
    DOI: 10.1111/eje.12070
    Epub 2013 Nov 25
24. Golchha V, Sharma P, Wadhwa J, Yadav D, Paul R. Ergonomic risk factors and their association with musculoskeletal disorders among Indian dentist: A preliminary study

using Rapid Upper Limb Assessment. Indian J Dent Res. 2014;25:767-71.
25. Rising DW, Bennett BC, Hursh K, Plesh O. Reports of body pain in a dental student population. J Am Dent Assoc. 2005;136(1): 81-6.
26. Gambhir RS, Singh G, Sharma S, Brar R, Kakar H. Occupational health hazards in current dental profession- A review. The Open Occupational Health & Safety Journal. 2011;3:57-64.
27. Alghadir A, Zafar H, Iqbal ZA. Work-related musculoskeletal disorders among dental professionals in Saudi Arabia. J Phys Ther Sci. 2015;27(4):1107-12.
DOI: 10.1589/jpts.27.1107
28. Horton SJ, Johnstone CL, Hutchinson CM, Taylor PA, Wade KJ. Clinical working postures of bachelor of oral health students. N Z Dent J. 2011;107(3): 74-8.
29. Thornton LJ, Barr AE, Stuart-Buttle C, Gaughan JP, Wilson ER, Jackson AD, et al. Perceived musculoskeletal symptoms among dental students in the clinic work environment. Ergonomics. 2008;51(4):573-86.
DOI: 10.1080/00140130701728277
30. Garcia PP, Presoto CD, Campos JA. Perception of risk of musculoskeletal disorders among Brazilian dental students. J Dent Educ. 2013;77(11):1543-8.

Peer-review history:
The peer review history for this paper can be accessed here:
http://sciencedomain.org/review-history/14295