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ERGONOMIC ASPECTS RELATED TO SADDLE DENTAL STOOLS: AN INTEGRATIVE LITERATURE REVIEW.

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ABSTRACT

Inappropriate postures in the workplace are often associated with occupational disorders. In this context, the aim of this study was to investigate the influence of saddle-type dental stools on operator posture maintenance. An integrative literature review was conducted, consulting the Medline (N=539) and SCOPUS (N=175) databases. After excluding duplicates and studies that did not meet the inclusion criteria, 13 articles were selected for analysis. Despite technological and ergonomic advancements, it is worth noting that prolonged working hours, improper postures, and ergonomic risk factors can lead to irreversible musculoskeletal disorders. In the dental context, professionals are frequently exposed to dynamic and detrimental postures in their daily routines. Saddle-type stools have been designed considering the postural needs of operators. Studies have shown that dynamic seats, such as saddle-type stools, promote a neutral posture of the lumbar spine and provide better levels of muscular activation in the lower trunk muscles, contributing to area stabilization and reducing strain on the upper muscles. Therefore, the use of saddle-type stools can promote a more favorable and neutral posture for dental professionals.

KEYWORDS: Ergonomics, Occupational Risks, Dentist, Saddle dental Stool.

1. INTRODUCTION

Ergonomics (or Human Factors) is the scientific discipline that deals with understanding the interactions between humans and other elements of a system and the profession that applies theories, principles, data, and methods to projects aimed at optimizing human well-being and overall system performance (International Ergonomics Association, 2008).

Ergonomics can be categorized into four distinct types: participation, correction, design, and awareness. The participatory approach aims to engage the worker in solving intrinsic challenges in the work environment, while correction is intended to address concrete obstacles

in the work process. Design, on the other hand, focuses on supervising the development of work instruments to ensure they can be used by workers with maximum comfort and safety, preventing possible accidents, injuries, or discomfort during their use. Finally, awareness plays the role of promoting professional development, emphasizing the importance of the principles governing their relationship with the work environment, encouraging them to perform their duties diligently based on these principles (Rovida et al., 2015). Despite ergonomics being recognized as a scientific discipline and a profession of great importance for optimizing human well-being and overall system performance, dental professionals still demonstrate little familiarity with the knowledge of work rationalization and ergonomics (Naressi et al., 2013).

Within the ergonomic context, unfavorable working postures are one of the leading causes of Work-Related Musculoskeletal Disorders (WRMSDs). The role played by dentists leads them to adopt poor postures, such as leaning laterally, making flexion and extension movements of the spine during the workday, and sitting for long periods (Garbin et al., 2009). Work-Related Musculoskeletal Disorders (WRMSDs) can cause pain in various parts of the body, such as the neck, shoulder, arm, wrist, hands, upper and lower back, hips, knees, and feet (Graham, 2002). These musculoskeletal pains represent an occupational health problem for dental professionals, especially for dentists and dental hygienists who adopt static postures and perform precise hand and wrist movements (Graham, 2002; Lindfors et al., 2006). In two recent literature reviews on the general health of dentists and occupational health in dentistry, WRMSDs were identified as a significant issue for this profession (Leggat et al., 2007; Puriene et al., 2007). As noted by YI et al. (2013), there is a prevalence of WRMSDs in the neck, trunk, and lower back region among dentists, especially those working in the field of periodontics. In another study, professionals reported the highest complaints in many parts of the body, except for the wrist and knees, as pointed out by Hokwerda, Ruijter, and Shaw (2006). A recent systematic review revealed that the prevalence of musculoskeletal pain in dental workers ranges from 64% to 93%. Among dentists, the most affected areas by pain are the back, with an incidence of 36.3% to 60.1%, and the neck, with an incidence of 19.8% to 85%. Among dental assistants, the hands and wrists are the most prevalent regions, with an incidence of 60% to 69.5% (Hayes, Cockrell, and Smith, 2009). It is worth noting that Work-Related Musculoskeletal Disorders (WRMSDs) are influenced by multiple factors, including static and uncomfortable postures, repetitive and excessive force, inadequate lighting, incorrect positioning of both the patient and the dental professional, lack of dental assistants, individual characteristics such as physical fitness, height, weight, overall health, gender, and age, as well as stress, play a significant role in the development of WRMSDs (Plessas and Delgado, 2018; Sakzewski and Naser, 2014).

When analyzing available studies, it is possible to observe that anatomical saddle-type dental stools have the best levels of muscle activation in the lower trunk muscles, responsible for better stabilization of the region and decompression of the upper muscles, as evidenced in the studies by De Bruyne et al. (2016) and Tran et al. (2016). It is observed that, despite technological and ergonomic advancements in the field, improper postures, excessive working hours, and exposure to ergonomic risk factors can still cause irreversible musculoskeletal disorders (Garbin et al., 2011; Pîrvu et al., 2014; Gupta et al., 2014). Previous studies also indicate that the use of saddle-type seats can reduce postural risk and prevent musculoskeletal injuries when compared to conventional seating (Gandavadi, Ramsay, & Burke, 2007; Dable et al., 2014).

The high prevalence of pain and musculoskeletal disorders among dentists is widely recognized. However, it is important to emphasize that the proportion of studies addressing new ergonomic seating designs and their implementation in the dental field is considerably low.

Several studies (Gandavadi et al., 2007; Haddad et al., 2012; Custódio et al., 2012; Dable et al., 2014; Tran et al., 2016; De Bruyne et al., 2016) support this finding.

2. OBJECTIVES

In this study, the objective was to conduct an integrative literature review to investigate the impact of the use of dental stools, especially saddle-type stools, with a focus on optimizing posture during dental procedures.

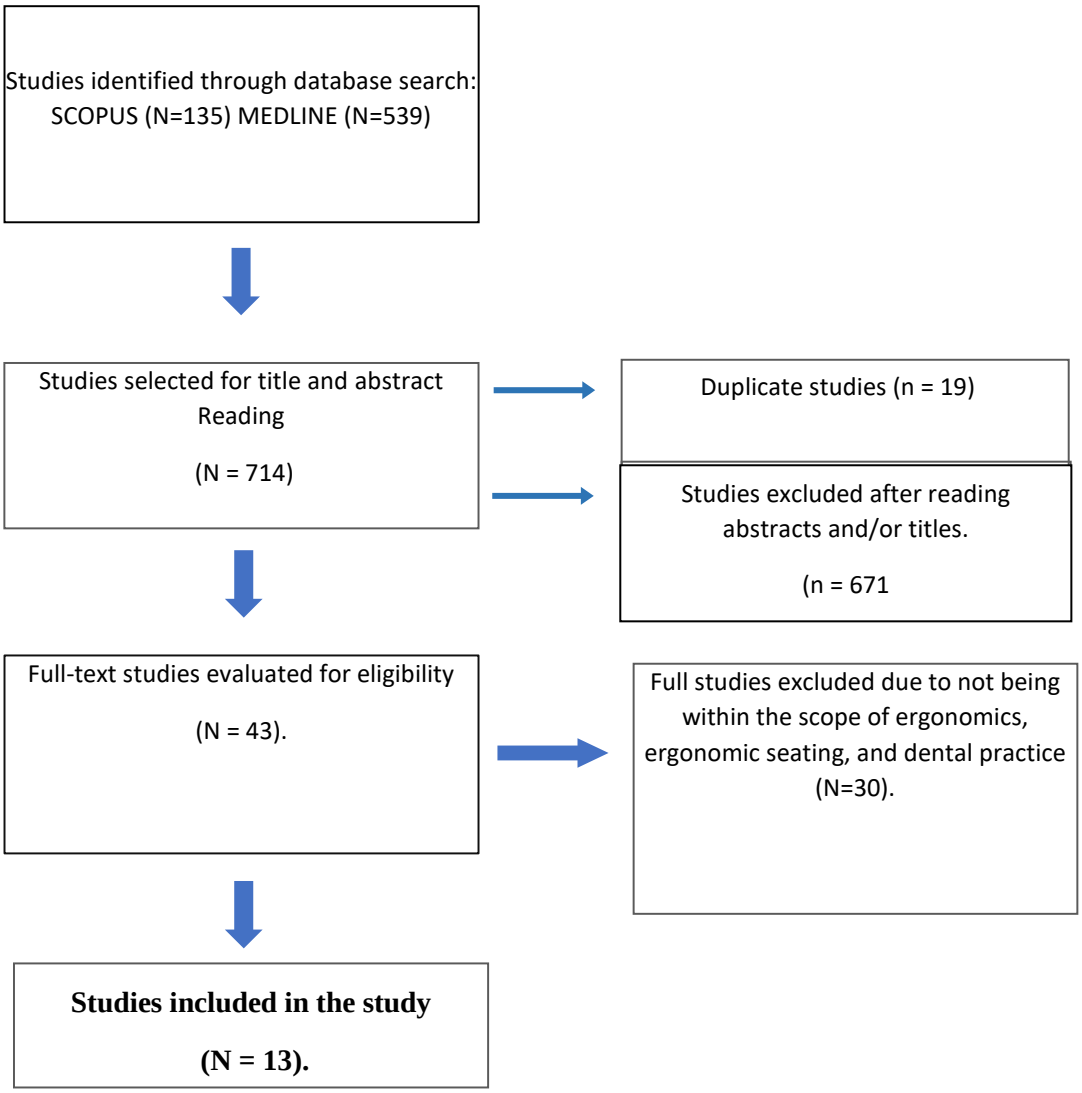
3. METHODOLOGICAL PROCEDURES

This research adopted an integrative literature review approach; integrative review is a specialized method that seeks to synthesize existing empirical or theoretical literature to provide a comprehensive understanding of a specific phenomenon (BROOME, 2006).

The methodology involved searching for studies in the Medline and Scopus databases. The choice of these databases is due to their widely recognized status as comprehensive sources of scientific literature in the fields of health, dentistry, and ergonomics. Searches in the databases were conducted between June and September 2022, aiming to cover scientific literature available up to that date. The search was conducted using keywords and appropriate truncation characters and Boolean operators, such as AND and OR, to maximize search comprehensiveness. The following terms were used: "saddle chair" OR "saddle seat" OR "dentist's chair" OR "traditional dental chair" OR "conventional seats" AND "ergonomics" OR "Sitting Position" OR "Posture" OR "DORTS" AND “dental office” OR "dentist". Initially, an analysis of the titles of the identified studies was conducted to exclude duplicate articles and assess the preliminary relevance of the works in relation to the research objectives. Inclusion criteria for this review were established based on the type of study, seeking experimental and observational studies that analyze the relationship between dental seating, biomechanics, and ergonomics. The target population consisted of dental students and dentists. The intervention of interest was the use of one or more types of seats during clinical or pre-clinical dental procedures. Evaluated outcomes included musculoskeletal comfort and/or postural alignment. Exclusion criteria for this review included publications that addressed standing posture, as well as theses, dissertations, books, book chapters, manuals, reviews, critiques, comments, editorials, conference proceedings, and scientific reports. In this integrative review process, specific tools were not used. The review was conducted manually by reading selected articles and extracting relevant data, presented in Table 1.

4. RESULTS AND DISCUSSIONS

Figure 1 - Flowchart of the integrative literature review



The present integrative literature review aimed to investigate the impact of the use of dental stools in improving posture, promoting ergonomic work positions, and preventing musculoskeletal injuries among dental professionals. Initially, a total of 714 studies were identified in the databases, with 539 found in Medline and 175 in SCOPUS. Out of these studies, 19 were excluded as duplicates. After the analysis of titles and/or abstracts, 671 studies that did not meet the inclusion criteria or were not within the scope of this review were excluded. After the initial screening, 43 articles were left for full reading. During this stage, 30 articles were excluded as they did not fit the scope of ergonomics, ergonomic seating, and dental practice, leaving 13 articles that were considered relevant and included in this review. The selection of articles took into consideration their contribution to the analysis of the impact of dental stools on the posture of professionals and the prevention of musculoskeletal injuries.

The selected articles underwent analysis, where aspects such as the influence of the stool on the professionals' posture, the ergonomic benefits provided by the saddle stool intervention, and its role in preventing musculoskeletal injuries were discussed, as can be observed in Table 1. Among the study limitations, the scarcity of available articles is highlighted.

Table 1 - Analyzed articles considered suitable for the research, comprising the study sample:

Author/year	Magazine	Location	Type of study	Objectives and Methods	Main results
Huppert., et al 2021	BMC Musculoskeletal Disorders	Germany	Randomized Clinical Trial	To assess the effect of different ergonomic chairs on postural maintenance, comparing the usual sitting posture with the working posture. The study involved 59 individuals divided into two groups.	Intra-chair comparison revealed changes related to position in the sagittal plane, but not in the transverse plane. These changes were observed only in the forward-leaning working position and were not influenced by the ergonomic design of the respective chair. No differences were found between the groups in the assessment of each chair.
Bruyne., et al 2021	Applied Ergonomics	Belgium	Cross-sectional	To investigate the effect of different types of ergonomic stools on cervicothoracic muscle activity and posture during a dental procedure, the study used a sample of 25 dentists and three types of seats (Ghopec, Salli, and Adec) for data collection, recorded through the BodyGuard™ device and EMG measurements.	There were no significant differences between the Ghopec, the adjustable seat Salli MultiAdjuster, and the A-dec stool regarding posture or muscle activity in the cervicothoracic spine during the dental task. These results contrast with a previous study that focused on the lumbar spine, showing reduced lumbar flexion and lower muscle activity when sitting on the Ghopec.
RamanV, Ramlog S,Sweet, J., & Sweet, D 2020	British Dental Journal	England	Cross-sectional	To determine the ergonomic risk in conventional dental stools among 28 dental students using digital operator photographs, the study aimed to identify the risk of developing work-related injuries in dentistry through the REBA (Rapid Entire Body Assessment) scale.	High scores provided by the REBA identified specific areas of risk behavior, with 64% of the assessments indicating moderate risk according to the REBA scale. These results suggest that the use of static digital photographs as a REBA tool may be a useful and reliable option for assessing ergonomic risk in this context..
Garcia-vidal Et al., 2019	Journal of clinical medicine	Spain	Cross-sectional	To evaluate different ergonomic supports in 36 students using EMG to measure muscle activity during three dental restoration tasks. The tasks were performed without ergonomic support and then with each of the three ergonomic supports, with	The use of ergonomic stools was effective in reducing muscle activity compared to standard stool use, suggesting that these seats can contribute to a more appropriate posture and less muscle overload during clinical activities.

				a 15-minute interval between them..	
Labbafinejad, Y.,et al 2019	International Journal of Occupational Safety and Ergonomics	Iran	Cross-sectional	To assess musculoskeletal discomfort during work using a saddle-shaped seat compared to conventional seats in 73 dental professionals. Data collection was done using the Corlett and Bishop Body Part Discomfort (BPD) scale.	The saddle-shaped seat demonstrated better results in postural maintenance and muscle activation. There was a significant reduction in discomfort levels in various areas of the body, including the neck, shoulder, arm, back, elbow, and forearm, as well as an overall reduction in body discomfort ($p < 0.05$). Over 89% of the participants reported increased comfort during their work when using this seat.
Lopéz- Nicolás et al., 2019	The journal of life and environmental sciences	Spain	Cross-sectional	To evaluate the effect of different ergonomic supports on the activity of the trapezius and lumbar erector spinae muscles in 36 dentists during a dental procedure. Using a portable surface electromyography device, intraclass correlation coefficients (ICC) and the standard error of measurement (SEM) were analyzed to establish the reliability of the measurements.	The use of the saddle-shaped ergonomic stool resulted in a significant reduction in the activity of the trapezius and lumbar erector muscles.
Bruyne et al., 2016	Applied ergonomics	England	Clinical trial	To investigate the influence of different types of stools on muscle activation and lumbar posture maintenance. 25 participants performed a simulated dental procedure in a standard chair, a saddle chair, and the Ghopec chair.	Lumbar posture was closer to neutral in the Ghopec chair, while sitting in a standard chair/saddle resulted in more flexed/extended postures, respectively. Sitting at a 90-degree angle (standard chair) resulted in increased activation of back muscles, while sitting at a 125-degree angle (saddle and Ghopec) activated abdominal muscles to a greater extent, although to a lesser degree in the presence of a backrest (Ghopec). To maintain a neutral posture during dental procedures, the Ghopec chair is considered the most suitable design.

Turner et. Al , 2016	International jou rnal of occupati onal safety and ergonomics	Canada	Experimental research	To compare the level of back muscle activation in 30 dental students, aiming to record dorsal muscle activity in two back muscles, the thoracolumbar fascia and the lumbar iliocostal. An analog two-channel surface EMG system (Bagnoli2, Delsys, USA) was used in conjunction with EMGworks software to measure muscle activation.	The use of a thoracic support in dental stools shows a significant reduction in the muscle activity of the lumbar and dorsal muscles during the simulated working posture, compared to using a standard dental stool.
Dable., et al 2014	The journal of Indian prosthodontic so ciety	India	Cross-sectional	The study involved 90 dental undergraduates who were assessed for ergonomic risk during the execution of dental procedures using the RULA (Rapid Upper Limb Assessment) scale. The study's objective was to raise awareness about the importance of ergonomic posture from the beginning of the profession, aiming to prevent musculoskeletal injuries and ensure a safe working environment.	Conventional seats exhibited high scores on the RULA scale, indicating a high ergonomic risk, unlike the saddle seat (Salli). It was observed that the failure to adopt an ergonomic posture can increase the risk of musculoskeletal injuries in dental students.
Custódio Et al. 2012	Ios press	Brazil	Cross-sectional	To evaluate the influence of an abdominal support attached to the traditional stool in 10 female dental students during the execution of a clinical procedure.	The abdominal support applied to the dentist increased the muscle activity of some muscles but did not affect the weight distribution on the backrest. However, it can be used to promote a more protective position for the lumbar spine.
Haddad et al . 2012	The International Journal of Occupational and Environmental Medicine	Iran	Experimental research	To assess a common chair with a new ergonomic design that incorporated a forward-leaning stool with chest and arm support in 12 dentists.	When incorporating a chest and armrest into the conventional chair, it may reduce shoulder issues by reducing muscle activity in the area.

Gandavadi e t al. 2007	British dental journal	England	Pilot study	To assess working posture in 70 dental students using different types of dental stools to determine if a seat predisposes to a posture difference.	Based on the scores obtained using the RULA method, it is evident that students using a closed saddle-type seat can maintain an acceptable working posture, with a lower risk rating compared to those using the conventional seat, which exhibits a higher risk score for posture.

Source: Authors (2022)

4.1 TYPES OF SEATS USED AND THEIR IMPACT ON POSTURAL MAINTENANCE

The heterogeneity of the studies included in this review, which encompassed clinical trials, cross-sectional studies, and experimental studies, makes comparative analysis unfeasible. However, eight of the analyzed studies showed an improvement in postural alignment after the intervention (Gandavadi et al., 2007; Custódio et al., 2012; Haddad et al., 2012; Dable et al., 2014; De Bruyne et al., 2016; Garcia-vidal et al., 2019; Labbafinejad, Y., et al., 2019; Lopéz-Nicolás et al., 2019). The authors used saddle-type seats from different brands: the Salli saddle chair (open saddle), Bambach Saddle Seat (closed saddle), Salli MultiAdjuster, A-dec, and Ghopec. Studies using saddle-type seats, both open and closed, suggested a lower postural risk compared to conventional seats, allowing for a more ergonomic work posture and potentially preventing musculoskeletal injuries.

De Bruyne et al., 2021, suggest that there are no significant differences between the types of saddle-type ergonomic seats. The results obtained by the authors indicated that there was no difference in terms of posture or muscle activity in the cervicothoracic spine between seats from the brands: Ghopec, Salli Multi Adjuster, and the A-dec stool during dental procedures. The same authors conducted an experimental study in 2016, where the lumbar posture was closer to the neutral position in the Ghopec chair, while sitting in a conventional chair resulted in more flexed/extended postures at a 90-degree angle, leading to greater activation of back muscles. Sitting at a 125-degree angle (saddle and Ghopec) activated more abdominal muscles, although to a lesser extent in the presence of a backrest (Ghopec).

Other ergonomic devices attached to dental stools also suggest a reduction in muscle activity, as found by Custódio et al. (2012), where a conventional Dabi Atlante seat, Ergo Relaxe model, with an abdominal support in the experimental group was used, while the control group used the same seat without the abdominal support. Statistical analysis revealed an increase in electrical activity in the right trapezius, left trapezius, and right longissimus thoracis muscles when an abdominal support was applied to the dentist. This indicates that the application of trunk support could interfere with the electrical activity of most muscles studied, promoting a more aligned position with the body's central axis, thus protecting the passive elements of the lumbar spine.

In Haddad et al.'s study (2012), the experimental group used a seat with a new ergonomic design that incorporated forward seat tilt and chest and arm supports, while the control group used a conventional seat. The authors found that incorporating a chest and arm rest into a conventional dental chair can reduce shoulder problems associated with the prolonged posture of trunk flexion with shoulder adduction commonly observed in dentists.

4.2 ERGONOMICS AND ITS CONTRIBUTIONS TO TECHNOLOGICAL ADVANCEMENTS

Ergonomics plays a prominent role in ensuring the capacity and effectiveness of healthcare professionals, which, in turn, results in higher-quality patient care (Gupta, Bhat, Gupta, Mohammed, & Bansal, 2014). Therefore, it is necessary to consider not only technological advances but also ergonomic concerns in the development of production projects for goods, services, and products. Through its innovative approach, ergonomics seeks to ensure effectiveness, safety, and the prevention of accidents and musculoskeletal disorders, establishing a connection between design projects and technological advancements (Hokwerda et al., 2006). Regulatory Standard No. 17 of 2007 plays a crucial role in ensuring an appropriate working environment for dentists. This standard stipulates that the workstation should be designed or adapted to allow tasks to be performed in a seated position (Hokwerda et al., 2006). This guideline aims to promote ergonomics in the dental environment, recognizing the importance of correct and comfortable posture for the health and well-being of professionals. A significant milestone in the development of dental ergonomics is the ISO/TC 106/SC 6 N 411 Standard Project, titled "Ergonomic requirements for dental equipment." This project is an important reference that provides guidelines and recommendations for the design, construction, and selection of dental equipment, taking into account available knowledge of human anatomy, physiology, and ergonomics. One of the main contributions of this project is to provide information on the correct, comfortable, safe, and healthy posture for dentists during dental procedures. Based on scientific studies and specialized knowledge, ergonomic guidelines are established to make appropriate equipment choices that promote correct posture, avoiding excessive effort, muscle tension, and musculoskeletal injuries. The ergonomic guidelines aim to provide a safer and healthier working environment for professionals, minimizing the risks of health problems related to dental practice (Garbin et al., 2009). By adopting an ergonomic-based approach, it is possible to promote the comfort and safety of professionals, contributing to the quality of services provided, a reduction in work-related injuries, and patient satisfaction.

In the context of ergonomic and technological advances, it is essential to emphasize the importance of using suitable chairs, adjustable stools, and correctly positioning mobile equipment. These measures have been effective in reducing problems related to musculoskeletal disorders (MSDs), allowing professionals to make modifications and optimize their workspace. A notable example is the availability of ergonomic saddle seats on the market, which promote a healthier posture. With a saddle seat, the pelvis rotates forward, and the lumbar spine assumes the correct curvature, thereby reducing the risk of musculoskeletal problems during dental activities (Gandavadi & Ramsay, 2005).

4.3 DISCOMFORT AND MUSCULOSKELETAL RISKS IN DENTAL PRACTICE: THE IMPORTANCE OF ERGONOMICS IN DENTAL STOOL DESIGN.

Initially, dentists used to work standing up, but over time and with the development of working philosophy, dental practice has evolved significantly. Professionals transitioned from a standing position next to the chair to a seated position. With technological advancements, more suitable chairs, adjustable stools, and mobile equipment emerged, all well-positioned, which helped reduce related problems (Dable et al., 2014). However, dentists are still a population susceptible to joint and muscle pain due to improper postures. According to Maehler (2003), despite technological and ergonomic advances, dental professionals face discomfort due to excessive working hours and individual predisposition to skeletal degenerations affecting the spine. International literature reveals that approximately 65% of dentists, that is, 2 out of every 3, suffer from musculoskeletal problems, varying in severity and involving symptoms

like discomfort, pain, functional difficulties, and loss of work time. The risk of disability, whether total or partial, as a result of physical factors or a combination of mental and physical factors, is considerable. Muscle tension increases proportionally with stress, as does muscle load. Furthermore, physical load is often already high (Read, Salmon, Goode, & Lenné, 2018).

According to Dul et al. (2012), these risks can affect the physical and mental well-being of professionals, compromising their safety and productivity, resulting in discomfort and/or illnesses. Ergonomic risks considered include improper manual handling of loads, incorrect postures and movements, repetitive movements, direct pressure on body tissues, vibrations, and thermal discomfort in the environment.

Dental practice requires daily dynamic and harmful postures that cause cumulative bodily microtraumas. The harmful consequences of this process lead to various unhealthy physiological adaptations, such as decreased oxygenation, painful musculoskeletal dysfunctions, and bone degeneration (Maehler, 2003).

In dentistry, professionals are exposed daily to dynamic and harmful postures that cause cumulative bodily microtraumas. These harmful consequences lead to various unhealthy physiological adaptations, such as decreased oxygenation, painful musculoskeletal dysfunctions, and bone degeneration (Hayes, Cockrell, and Smith, 2009). According to De Sio et al. (2018), in a literature review analyzing 29 articles, the most significant ergonomic risk factors related to dentistry were static posture, repetitive movements, muscle imbalances, non-ergonomic equipment, duration and extent of muscle effort, and vibrating instruments. Garbin et al. (2009) also emphasize that the most common occupational risk factors perceived by professionals include improper bending of the spine and prolonged periods in the same position. Hayes et al. (2013) showed that even in a correct posture on a common stool, 50% of the body's muscles contract and limit vertebral movements. The studies by Gandavadi and Ramsay (2005) and Gandavadi, Ramsay, and Burke (2007) investigated the influence of different seating positions on the upper limb function and posture of dental students. These studies demonstrated that the proper choice of seating position can have a significant impact on the function and musculoskeletal health of professionals. Highlighting the importance of considering ergonomics in the design and use of dental stools to promote working positions that minimize the risk of injuries.

4.4 The Relationship Between Ergonomics and the Selection of the Right Stool Type

The dental stool is directly related to ergonomic practice, and its anthropometric dimensions should comply with ABNT NBR 13962/1998. Among the ideal features are: five casters to allow movement without the risk of falling, seat height that accommodates a height range from 1.50 m to 1.80 m, and a backrest that properly supports the lumbar spine with vertical and horizontal adjustments for professional adaptation.

The conventional stool has few differences among its manufacturers, with aesthetics and ergonomics mostly resembling an office chair. It is characterized by geometric seat and backrest, height adjustment for both, and a five-caster structure for mobility. While the geometric shapes with adjustment facilitate adaptation to any user, their less anatomical shapes, lack of support for the upper limbs, and the absence of anterior trunk support are negative points to consider (Bertolaccini, Paschoarelli & Medola, 2015). In contrast, the saddle seat promotes a healthy posture, contributing to the maintenance of the lumbar region and associated with

reduced disc pressure. Furthermore, studies suggest that a saddle seat reduces physical workload on the arms and trunk during dental procedures (Dable et al., 2014).

The Saddle-type stool was designed with the postural needs of professionals in mind. It offers a comfortable and convenient posture with the legs at a 45º angle downward, tilting the pelvis into an almost neutral position, akin to standing, providing a natural curve for the lower back and maintaining the shoulder-neck region erect (Dable et al., 2014). Authors like Kothiyal & Kayis (2001) suggest that ergonomic stools reduce hip flexion, promote a better lumbar and spinal posture, and are associated with less muscular tension.

An example of a stool manufactured by the Salli company features a saddle-type ergonomic seat and a five-caster structure. This configuration ensures greater comfort for the upper limbs as the support is articulated, allowing a wider range of arm positions. The saddle-inspired seat design contributes to maintaining a neutral posture, i.e., with zero degrees of trunk inclination (Dable et al., 2014). Recent studies, such as those by Garcia-Vidal et al. (2019) and Lopez-Nicolaz et al. (2019), emphasized the important role of the stool in maintaining posture and reducing upper muscle activity, favoring ergonomics during working hours and reducing the risk of injuries.

The saddle-type seat concept was developed based on studies presented by Corlett, which indicate the correct sitting posture. This type of seat was designed to prevent the buttocks and thighs from compressing against the chair, providing firm support for the ischial bones. With the thighs sloping downward, forming an angle of 120 to 130º relative to the trunk, the pelvis adopts an almost neutral position, similar to a standing position, and the knee angle is extended. This allows the lower lumbar region and the upper trunk to assume a natural and relaxed posture without the need for support (Corlett & Bishop, 1976; Corlett, Madeley & Manenica, 1979). Dynamic seats, such as the saddle-type seat, favor a neutral posture of the lumbar spine. These seats allow constant movement due to the chair's design, even while sitting. Thus, the saddle seat significantly differs from the traditional way of sitting (Gouvêa, 2015). Postural control requires a complete interaction between the neural and musculoskeletal system, with the activation of limb and trunk muscles through spinal signals (Gunning, Callaghan, & McGill, 2001).

According to Gouvêa (2015), the saddle seat has been widely used by healthcare professionals, especially dentists, as a preventive or corrective measure for postural problems. This is because the saddle seat reduces posterior pelvic rotation, facilitates the positioning and maintenance of the physiological curvatures of the spine, and minimizes intradiscal compression.

Studies that have assessed the conventional stool in comparison to the saddle-type stool, with or without armrest support, point to better results in terms of the overload on lumbar, intercostal, and shoulder muscles (Haddad et al., 2012). However, although the modification of the conventional stool appears to be effective, the benefits found in studies, such as those by Garcia-Vidal et al. (2019) and Lopez-Nicolaz et al. (2019), are limited. It is observed that, in most of the analyzed studies, anatomical stools showed the best levels of muscle activation in the lower trunk muscles, responsible for better stabilization of the area and decompression of the upper muscles, as seen in the studies of Bruyne et al. (2016) and Turner et al. (2016). The upper body muscles, especially in the back and shoulder region, are actively engaged during dental procedures and are often responsible for the onset of inflammatory disorders such as bursitis, tendinitis, and other joint disorders. Therefore, finding solutions that minimize the

activation of these muscles is of utmost importance for the longevity of professional performance (Oliveira and Saraiva Neto, 2018; Almeida and Stefenon, 2018).

5. Conclusion

In conclusion, this integrative study highlights the importance of using saddle-type dental stools to improve posture during dental procedures, thus contributing to the occupational health of professionals. The results emphasize the need to consider the appropriate choice of stools as an effective strategy for preventing musculoskeletal injuries and enhancing clinical performance. To advance in this field, it is suggested that future studies explore specific ergonomic mechanisms, assess complementary interventions, and deepen the understanding of the benefits of different stool types for the health and well-being of professionals.

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