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RESEARCH ARTICLE

BODY MASS INDEX A RATIONALE TO CONCEDE FOR ERGONOMICS ASSOCIATED MUSCULOSKELETAL DISORDERS AMONG PRIVATE DENTAL PRACTITIONERS : A CROSS-SECTIONAL STUDY

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ABSTRACT

Background: Nowadays, musculoskeletal ailments are not unusual amongst dentists. Excess body weight and lack of practising ergonomic principles in their practice could also have an additive effect. ***Aim:*** This scientific research intends to determine the association between body mass index and ergonomics-related musculoskeletal disorders among privately practising dentists at Saidapet Neighbourhood of Chennai city, Tamilnadu, India. ***Materials and Method:*** A cross-sectional study was directed among 117 dental surgeons practising at Saidapetneighbourhood of the Mambalam taluk, Chennai city, Tamil Nadu, India. The multistage cluster sampling technique was employed to designate the study population. The Quetelet index was subsequently used to record each participant's height and body weight. A previously validated (as per the Canadian Center for Occupational Health and Safety- CCOHS) questionnaire consisting of 12 open-ended and closed-ended questions was utilized to obtain information regarding demographics, work information, symptoms, and causes of musculoskeletal pain. Statistical analysis was done using descriptive statistics and the Chi-square significance test. A probability density value (p-value) less than 0.05 was considered statistically significant. ***Results*:** There were positive correlations not only between the body mass index and the number of years of private dental practice (P value < 0.02) but also between the degree of interference of their musculoskeletal pain with their performance at clinics (P value <0.04) and interference of their musculoskeletal pain after work (P value <0.01). **Conclusion:** Abnormal body mass index was also an additional causative factor for ergonomics associated musculoskeletal disorders. Thus, dentists must abide by the ergonomic principles and the OSHA (Occupational Safety and Health Administration) guidelines while keeping an eye on their body weight and personal health.

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INTRODUCTION

Ergonomics-associated musculoskeletal disorder (EAMSD) is one of the significant perils for dental surgeons across the globe [(1)]. Pursuing the occupational safety and health administration (OSHA), dentists, an indispensable part of the healthcare services, stand first on the list of high-risk occupations.

Apart from this profession, nurses, nursing assistants, psychiatric aides, firefighters, construction labourers, stock movers, janitors, cleaners, housemaids, bus drivers, policemen, mechanics, plumbers, truck drivers, transportation, warehousing, etc. can be considered to be high-risk jobs. Ergonomics is fitting a job to a person; the fundamental schemes of an ergonomic process include: providing management and support, involving workers, providing training, identifying problems, encouraging early reporting of

musculoskeletal disorders(MSDs), and implementing solutions to control hazards, evaluating the progress. MSDs ensue as a fruit of overexertion involving outside sources, repetitive movements involving micro-tasks, other multiple exertions or bodily insults, and rubbed muscles - abraded or jarred by vibration. Studies conducted earlier have revealed that musculoskeletal disorders in the dental field account for the excused absence, decreased proficiency, and dentist depreciation (Prudhvi, 2012). The dental profession is a taxing job. It requires one to have enormous ocular acuity, exploitory potential, psychomotor expertise, manual finesse, and the capacity to keep up stationary poise all day (Durgha, 2014). The etymology of the word 'ergonomics' — ergo + nomy + ic, from Ancient Greek :(ergo," work") and (nomos "the rules of a discipline").Ergonomic principles are fundamental to gauge the efficacy of a person in his working environment. Dodging the ergonomic principles results in MSDs, impeding doctors from being exemplary dentists due to the damage caused to their musculoskeletal system comprising ligaments, tendons, muscles, bones, and nerves. This damage to their muscles is the result of repetitively performing similar or the same movements, exerting excessive force, and working in awkward postures. Hence, the dentist should follow appropriate posture like sitting with the thighs corresponding to the floor, feet reposing on the floor and back plus neck erect, handling objects above the elbow height and standing in the 7 o' clock(right), 9'o clock (direct right), 11 '0 clock (right rear), 12'0 clock (direct rear) positions, while working on posterior maxillary teeth, horizontal impaction cases and scaling. Additionally, avoid overworking, resulting in localized pressure on the body part (thumb, index finger, and foot). The popular disorders afflicting the musculoskeletal system include carpal tunnel syndrome, rotator cuff tendonitis, degenerative disc disease, muscle cum tendon strain, trigger finger and thumb, tendonitis, ligament sprain, de Quervain's syndrome, thoracic outlet compression, ruptured or herniated disc, tension neck syndrome, radial tunnel syndrome, and lastly epicondylitis (Shaik, 2011). Securing a fixed demeanour by dental surgeons amid tasks provoking greater than 50% of their tissues to contract emanates musculoskeletal disorders (Valachi, 2003). Research disclosed musculoskeletal pain in dental surgeons as spanning from 60-78% (Shugars, 1987; Rundkrantz, 1990; Chowanadisai, 2000). The pervasiveness of MSDs was greater in dental surgeons as to specialists in general medicine [8]. According to a research held amidst dental personnel in Queensland, one in every ten personnels admitted seeking an annual mean excused absence of 11.5 days by virtue of musculoskeletal pain (Leggat, 2006). A plethora of etiologic factors are ascribed to MSDs in dental personnel, which comprise habitual forceful stationary stances to procure good accessibility, visibility, incorrect seating, and forceful wrist poise whilst scaling (Diaz-Caballero, 2010). Additionally, analytical considerations like the number of hours spent chair side in a day, the number of years of private dental practice (Cagnie, 2007), sex (Lindfors, 2006), heftiness, plus stature (Botha, 2014). Among these factors predisposing to ergonomics-associated musculoskeletal disorders, a question arises as to whether a high body mass index (overweight & obesity) per se potentiates the likelihood of contracting MSDs (about the neck, elbow, lower back, shoulder, hand and upper back). In the pretext of a study conducted earlier, which established the strong relationship between obesity & median nerve mononeuropathy of the wrist and MSDs of the ankle and sole (Werner, 2002; Viester, 2013; Nasl Saraji, 2005; Booth, 2014), cutting excess body weight in overweight and obese individuals is presumed to have minimized the risk of MSDs [18].Whilst obesity is a global issue, man oeuvres decreasing the BMI (Body Mass Index) could- if the proposed link exists- perhaps be an efficient prophylactic cum therapeutic approach for musculoskeletal disorders. Hence, this research aims to cross-sectionally study the association between body mass index and ergonomics-related musculoskeletal disorders among privately practising dentists of the Saidapet Neighbourhood of Chennai city, Tamilnadu.

METHODOLOGY

This cross-sectional scientific research was based on a questionnaire circulated to dental surgeons practising privately in the Saidapetneighbourhood. The Saidapetneighbourhood belongs to the Mambalam taluk of Chennai city, Tamilnadu. The Mambalam Taluk comprises the neighbourhoods of K.K.Nagar, Kodambakkam, Mambalam, Saligramam, Saidapet, Jafferkhanpet, Ashok Nagar, and Virugambakkam. This study utilized the multistage cluster sampling technique for designating the study participants. The ethical approval for this study was duly procured from the Ethical Committee at the Department Of Public Health Dentistry, SRM Dental College, Ramapuram. The estimated sample size was 104 and was calculated based on a prevalence rate of 64% and a confidence interval of 95% from previous studies. Out of the 125 dentists requested to participate in this study, 117 dentists were incorporated into this research abiding by the admittance norms of those amenable to taking part in this study and gave the apprised assent and imbibed all normal, overweight, and obese privately practising dental personnel.Exclusion criteria include those dentists who quit private practice following accidental cervical spine injuries, government dental practitioners due to old age, plus those who are underweight. Initially, the height and weight of the dentist were measured to calculate body mass index in kg/cm^2. Quetelet index was utilized for the classification of body weight and to define obesity. An OSHA questionnaire previously validated by the Canadian center for occupational health & safety, containing 12 open-ended and closed-ended questions regarding demographics, work information, symptoms, and causes of musculoskeletal pain, was given to the dentists in the Saidapetneighbourhood. Then, they were asked to fill in after recording their body mass index. The IBM SPSS software was used for statistical analysis. Descriptive statistics and a Chi-square significance test were employed. A probability density value less than 0.05 was reckoned as momentous.

RESULTS

The filled questionnaires were gathered from the dental personnel. Of the 117 participants, 64 were males, and 53 were females.As per table 1, an in-depth perusal of the details furnished by the recipients revealed that, 41.9% of them belonged to the age group of 20-30 years and were new to the field (i.e., six months to less than five years of experience). 13.7%had an experience of 5 to 15 years, and 44.4% of them have been practising dentistry for more than 15 years. While 53% spent less than 5 hours on the dental chair daily, 37.6% spent less than 8 hours, and 9.4% spent more than 8 hours daily. 13.7% had 5 to 15 years of experience, and 44.4% had more than 15 years of experience in practising dentistry.

Table 1. Personal Data of The Dentists

Ratio of participants by gender distribution	PERCENTAGE
Male	54.70%
Female	45.30%
Others	0%
Body mass index	
Normal	46.20%
Overweight	41.90%
Obese	12%
Years of practice	
0-5 years	41.90%
5 to 15 years	13.70%
More than 15 years	44.40%
Hours spent chairside in a day	
0to5	53%
5to8	37.60%
More than 8	9.40%
Main working position	
Standing	47.90%
Sitting	9.40%
Both	42.70%
Handling objects above elbow height	
Non - responders	0%
Yes	48.70%
No	51.30%

Table 2. Region of pain & its effect at various times after work in percentage

Regionofpain perceived by dental professionals	**Percentage(%)**
Neck and shoulder	5.10%
Neck and lower back	4.30%
Neck, shoulder, elbow, lower back	3.40%
Neck, shoulder, lower back	4.30%
Neck, elbow, lower back, foot	3.40%
Neck, wrist, lower back	3.40%
Neck, elbow, hand, lower back, foot	3.40%
Neck, shoulder, elbow, upper back, lower back	2.60%
Neck, shoulder, wrist, lower back	2.60%
Others	1.70%
Pain while working	**Percentage**
Less	36.80%
Same	38.50%
Worse	22.20%
Pain after work	
Less	38.50%
Same	40.20%
Worse	21.40%
Pain after a week away from work	
Less	63.20%
Same	20.50%
Worse	10.30%

While 47.9% stood during dental procedures, 9.4% practised sitting poise, and 42.7% used both stances. Additionally, 48.7% handled objects above their elbow height, while 51.3% did not. According to table 1 and table 2, while comparing the males to females, the latter were shorter and less obese than the former. Noted that 46.2% had normal BMI, 41.9% were overweight, and 12% were obese. Thus, 13.7% of the participants experienced lower back pain, followed by neck plus shoulder pain (5.1%) and neck, shoulder, and lower back pain (4.3%) in that order of occurrence. Table 3 indicates that these dentists' musculoskeletal pain also interfered with their nocturnal slumber to a certain extent. As per the data collected, musculoskeletal pain affected 18.8% of these dentists every night; 24.8% had some interference during sleep, and 56.4% did not encounter any hindrance at bedtime. Table 4 shows that there does exist a positive correlation between the body mass index and the number of years of private practice ($p<0.05$).

Table 3: Musculoskeletal Pain & Its Interference With The Personal Life Of The Dentist As A Percentage

Interference with work	Percentage
No	30.80%
Some	58.10%
Had to take a break	11.10%
Interference with life outside	
No	31.60%
Some	48.70%
Had to take break	19.70%
Interference with sleep	
No	56.40%
Some	24.80%
Affects me every night	18.80%

Table 4. The Body Mass Index And Its Relationship With Musculoskeletal Pain Among Dentists

Years of private practice	0.02^{*}(p – value)
Pain after work	0.04^{*}(p - value)
Pain intervening with work	0.01^{*}(p – value)

(* - Pearson Chi-square (p)value <0.05 was considered significant)

There also does exist a positive relationship between the body mass index and the degree of interference of their musculoskeletal pain with their performance at clinics ($p<0.05$) and the interference of their musculoskeletal pain after work ($p<0.05$).

DISCUSSION

The consummation of this research highlights the fact that the dental speciality is a taxing job. It is disheartening that dental surgeons are immensely prone to ergonomics - associated musculoskeletal disorders due to heightened physical dexterity in practice. No other medical experts are so much prone to such job-related maladies. During activities, the poise jeopardizes the dentists to bodily embarrassment, maladies of muscular and skeletal complex and irritability of the peripheral wing of the nervous system. Musculoskeletal disorders may also crop up in others due to personal aspects like smoking, being overweight, and non-standardised bodily endeavours. Sadly, in the pursuit of laudable money and in the pretext of earning for his subsistence, man has repressed his fundamental roots that food is a medicine; rather, the present scenario is that medicine is food. In this fast world, a healthy diet has been replaced by the more detrimental high-calorie diet concomitant with a relatively sedentary lifestyle that simply doesn't tie in. Dentists aren't an exception. Thus obesity is on the hike, aggravating the possibility of contracting ergonomics-associated musculoskeletal disorders. Robert A Werner *et al.* conducted a cross-sectional study to evaluate the pervasiveness of carpal tunnel syndrome cum upper limb tendinitis on 305 stomatologists. The latter attended the ADHA (American Dental Hygienists' Association) meeting in Washington, D.C. In his study, he concluded that dentists suffering from mononeuropathy of the median nerve could be heftier and that obese individuals were four times more prone to suffer from the entanglement of the median nerve at the wrist. However, the actual mechanism of injury was idiopathic (Werner, 2002). LauraViester *et al.* conducted a study to enunciate the connecting link between body mass index and symptomatology of muscular and skeletal systems combined amidst the office goers' sample of 44,793 and consummated that body mass index was positively related to the

symptomatology of the MSDs pertaining to the lower limbs. Moreover, on par with normal-weight individuals, obese and overweight individuals had an increased risk for MSDs and decreased resolution of symptoms (Viester, 2013). A study by J. NaslSaraji *et al*., Birjand city, Iran, brought a positive correlation between disorders of the ankle and sole and the body mass index (Nasl Saraji, 2005). While carrying out routine dental attributes, the dental surgeon's perpetual malposition is versatile to imminent bodily constraints. These complications manifest as pain in various body parts, viz. back, hand, shoulder, and neck. Booth *et al*. have proved that multiple morbidities are highly associated with soaring BMI and obesity (Booth, 2014). If neglected, some of these issues may evolve into eternal skeletal disfigurement. The premature pullout is the aftermath of perpetual musculoskeletal maladies. Dan Anton *et al*. found a significant relationship between BMI and the incidence of carpal tunnel syndrome among dentists (Anton, 2002). According to a survey conducted by Forouzan Rafie *et al*. among 130 dentists, BMI was not in the slightest bit pertinent to the predominance of musculoskeletal ailments (Rafie, 2015). Still, in this research, body mass index is significantly attributed to the interference of the musculoskeletal pain experienced by the dentists during work and after work and directly related to the number of private practice years. According to Prudhvi *et al*., BMI was significantly correlated with pain in the lower back (Prudhvi, 2016). In the view of MJ Hayes and others, the commonest sites of MSDs were the dorsum of the trunk(36.3%-60.1%), neck (19.8-85%), followed by the wrist plus hand(60-69.5%) (Nokhostin, 2016) and in this study, 13.7% of the dentists had a pain of the lower back succeeded by neck along with the pain of the shoulder (5.1%)and neck, shoulder &lower back pain(4.3%). The conclusion of a study performed by Mohammed Reza Nokhostin and his associates, among the licensed dentists at the Medical Council of the Islamic Republic of Iran(MCIRI)- (Iran), age, elevated BMI and sedentary lifestyle directly correlated with musculoskeletal problems. In Iran, musculoskeletal problems have been reported among rubber factory workers, so a similar study was done among dentists. The study result showed that 77.25% of the Iranian dentists used to work seated, and 22.75% worked standing. Still, in this study, 47.9% of the dental surgeons stood while 9.4% sat, and 42.7% used both the poises. Furthermore, 18.52% of the Iranian dentists took a leave of absence to recover from musculoskeletal pain [(21)]. In contrast, in this study, 11.1 % of the dentists took a break from work owing to musculoskeletal pain. According to Robert A. Werner *et al*., in their study to estimate the connecting link between body mass record and the diagnosis of carpal tunnel syndrome, 43% of hefty females plus 32% of obese males suffered from carpal tunnel syndrome in comparison to 21 % of lean women and of lean men[(22)]. Our misfortune is that the incidence of musculoskeletal disorders in dentists is rarely documented. Moreover, there is a lack of renowned studios, pamphlets, or mandatory courses for enlightening the dental personnel regarding the perils in store due to dodging the ergonomic principles and the OSHA (Occupational Safety and Health Administration) guidelines at work. Thus, the need of the hour is to instil these protective guidelines in the minds of dentists all over the globe.

LIMITATIONS: This study was conducted amongst a tiny population of dental surgeons. As a result, males were more than females leading to gender bias. In addition, the credibility of the data regarding age, height, and weight furnished by the dentists is at stake resulting in confounding bias.

CONCLUSION

Although this study aimed at establishing that body mass index per se potentiates the risk of acquiring musculoskeletal disorders, it is hypocritical. Rather abnormal body mass index is an additional attribute for ergonomics-associated musculoskeletal disorders. Thus, dentists must abide by the ergonomic principles and the OSHA guidelines tenaciously. Along with a constant check on their BMI, consuming a salubrious diet, and inculcating regular physical exercises cum yoga in their daily schedule for a safer and evergreen dental practice.

CONFLICTS OF INTEREST: Nil

SOURCE OF FUNDING: Nil.

GLOSSARY OF ABBREVIATIONS

- **ADHA-**American Dental Hygienists' Association
- **BMI-** Body Mass Index
- **CCOHS-** Canadian Center for Occupational Health and Safety
- **EAMSD** – Ergonomics Associated Musculoskeletal Disorders
- **MSDs-**Musculoskeletal disorders
- **MCIRI-**Medical Council of theIslamic Republic of Iran
- **OSHA-**Occupational Safety and Health Administration

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