

## Original Research

### Evaluating the prevalence of work-related musculoskeletal disorders (MSDs) and assessing ergonomic awareness and practices among dental practitioners in Nashik

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#### ABSTRACT:

Dental practitioners are at high risk of work related musculoskeletal disorders (WMSDs) due to prolonged static postures and repetitive movements. Despite the importance of ergonomics in preventing these issues, many dentists lack awareness or fail to implement proper ergonomic practices. In Nashik, there is limited research on the ergonomic challenges faced by dental professionals. This study was aimed to assess the prevalence of WMSDs, evaluate ergonomic awareness, and identify risk factors among dentists in Nashik. The structured questionnaire was shared via online platforms (Google Forms, emails, or WhatsApp groups) and distributed as printed copies for those preferring offline participation. The chi square test was carried out to detect any statistically significant difference ( $p < 0.05$ ). Logistic regression was carried out to detect the most significant factors associated to WMSD occurrence

Out of the 152 participants, a high proportion of dental professionals (84.6%) were affected by WMSD in the last 12 months. A higher prevalence was found in females (87%) when compared to males (80%). The prevalence of WMSD was correlated to the working hours/day and hour/week, with a higher risk for operators working >5 h/day and >30 h/week. The most affected body areas were neck (59.9%), shoulders (43.3%), lumbar region (52.1%), dorsal region (37.7%) and wrists (30.6%). Endodontists reported with maximum musculoskeletal pain (90.02%) out of all the specialists. Only 12.7% dentists were aware and followed the ergonomic practices in daily routine.

**Keywords:** musculoskeletal diseases, ergonomics, dentistry, pain, neck, endodontists

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#### INTRODUCTION

Work related Musculoskeletal disorders (WMSDs) refer to group of disorders that affect muscles, tendons, ligaments, joints, nerves blood vessels, and all supportive structures that play a role in movements. WMSD can initially begin as pain in upper limb involving forearm and wrist, further involving the upper and lower back, neck and shoulder, and finally affecting the lower extremities such as hip, thighs, knees, and ankles. If left untreated it may lead to degenerative and inflammatory changes in affected area.<sup>1</sup>

MSD are defined by the World Health Organization (WHO) as a disorder of the muscles, tendons, peripheral nerves or vascular system not directly resulting from an acute or instantaneous event.<sup>2</sup>

Ergonomics plays a crucial role in dentistry, ensuring that practitioners maintain optimal posture and minimize the risk of WMSDs. Dental professionals frequently engage in repetitive movements, prolonged static postures, and awkward working positions, which contribute to a high prevalence of musculoskeletal disorders affecting the neck, back, shoulders, and wrists. Studies indicate that over 60% of dental practitioners experience some form of

musculoskeletal discomfort, leading to reduced efficiency, absenteeism, and even premature retirement in severe cases.<sup>3</sup> The high precision required in dental procedures further exacerbates ergonomic challenges, as dentists often work in confined spaces with limited mobility, increasing physical strain over time.

Research suggests that incorporating ergonomic interventions such as proper positioning, frequent posture adjustments, and the use of ergonomic dental chairs and instruments can significantly reduce strain and prevent chronic conditions.<sup>4</sup> However, there remains a gap in localized research focusing on the ergonomic challenges faced by dental professionals.

The aim of the study was to describe the prevalence and the factors associated to work-related musculoskeletal disorders (WMSD) among dental professionals of Nashik (Maharashtra). No previous investigations were performed in Nashik, and little is known regarding the most affected body areas or of which factors result in significant association to WMSD occurrence.

The rationale of this study is to correlate the link between the occurrence of WMSDs and various demographics, work lifestyle of dentists and ergonomic awareness. Based on which ergonomic courses and training will be scheduled as a group to provide necessary knowledge related to the same.

## METHODS

This cross-sectional observational study was conducted after the approval from the Institutional Ethics Committee. The study subjects included the dental practitioners in Nashik which included general dentists as well as specialists. The collection of the research data was carried out from 1<sup>st</sup> August 2024 to 31<sup>st</sup> September 2024. The participants were informed regarding the study and written informed consent was obtained from those who were willing to participate in the study. Exclusion criteria for the study subjects were Dental students and interns who are not yet practicing independently, practitioners with preexisting musculoskeletal disorders unrelated to dental practice and dentists who decline to participate or did not complete the survey. Incompletely filled questionnaires were also excluded from the study. A self-administered questionnaire, which included four sections like

Part 1: basic demographic details

Part 2: questions related to work profile related and lifestyle practices

Part 3: ergonomic awareness and

Part 4: the affect of MSD on their work performance.

This structured questionnaire was shared via online platforms (Google Forms, emails, WhatsApp groups) and distributed as printed copies for those who preferred offline participation. 191 questionnaires were distributed to the dental professionals of the institution and they were asked to answer the questionnaire. The completed questionnaires were collected back within

a week. 39 subjects were excluded from the study (20 incompletely filled questionnaires, 19 subjects had preexisting physical ailments) after the initial screening.

Data entry was performed in Microsoft Excel and the statistical analysis was carried out using SPSS Version 30 (Chicago, SPSS Inc.). The chi-square test was applied to test the association between WMSD and each variable. The *p*-value was set to 0.05. Linear logistic regression was performed to examine the factors that may be related to the occurrence of WMSD. The following parameters were considered, namely gender, age, self-reported body fatness, height, dental occupation, working hours per day, working hours per week, years of work, physical activity, physical activity duration, physical activity frequency, mobilization activities and ergonomic knowledge. The *p*-value was set to 0.05.

## RESULTS

A total of 152 questionnaire were useful for the analysis. Concerning the gender, a slightly higher presence of females was present (57%), compared to males (43%) (Figure 1a). The age range showed a prevalence of young dental professionals, with age < 35 years (Figure 1b). Over 70% of the surveyed dental professionals reported a normal body fatness (Figure 1c). Most of the interviewed dental professionals were between 1.55 and 1.85 m height, namely distributed in 3 groups uniformly represented (30% each) (Figure 1). As regarding the main working occupation, most of the surveyed operators were general practitioners and dental hygienists (Figure 2a).

Most of the surveyed personnel worked 5–8 h per day (approximately 50%) or more than 8 h per day (over 30%) (Figure 2b). Very few surveyed operators worked less than 20 h per week (approximately 10%), most of the operators worked more than 30 h per week (Figure 2c). The number of years of work is uniformly distributed among dental professionals (Figure 2d).

Approximately 35% of the surveyed operators superficially know or do not know (over 40%) the ergonomic guidelines, while few operators had a satisfactorily knowledge (Figure 1).

A total of 84.9% participants reported a WMSD in the past 12 months. Of these, 83.1% declared a medically diagnosed MSD. WMSD that hampered daily routine in the last 12 months was observed in 30.1% participants. 42.9% operators experienced WMSD in the last 7 days (Table 2).

The percentage of WMSD increased with age, dental professionals under 35 years showed lower percentages when compared to older dental professionals, with a peak between 36–50 years (94.2%).

Dental specialists showed markedly higher percentages of WMSD-affected operators (90.8%) when compared to general practitioners (84.9%)

The years of work showed to increase the percentage of WMSD, with the highest percentages after 10–20

years of work (94.9%). Similarly, 90% of the operators working since 30–40 years showed WMSD (89.8%).

Table 2 Reports the prevalence of WMSD in relation to knowledge of ergonomics guidelines.

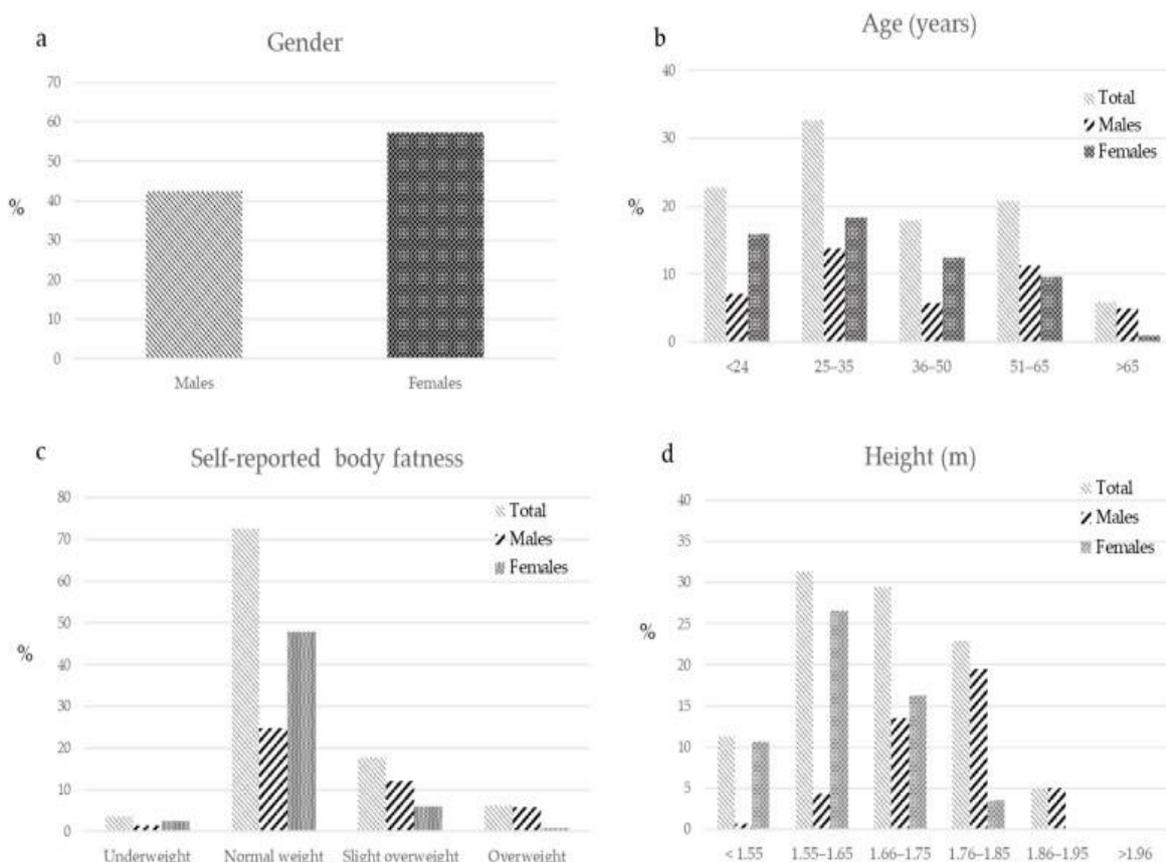
However, no statistically significant differences in WMSD prevalence in relation to the variables were observed.

Linear logistic regression is reported in Table 3. The analysis revealed that only gender and working hours per day parameters significantly affect the occurrence

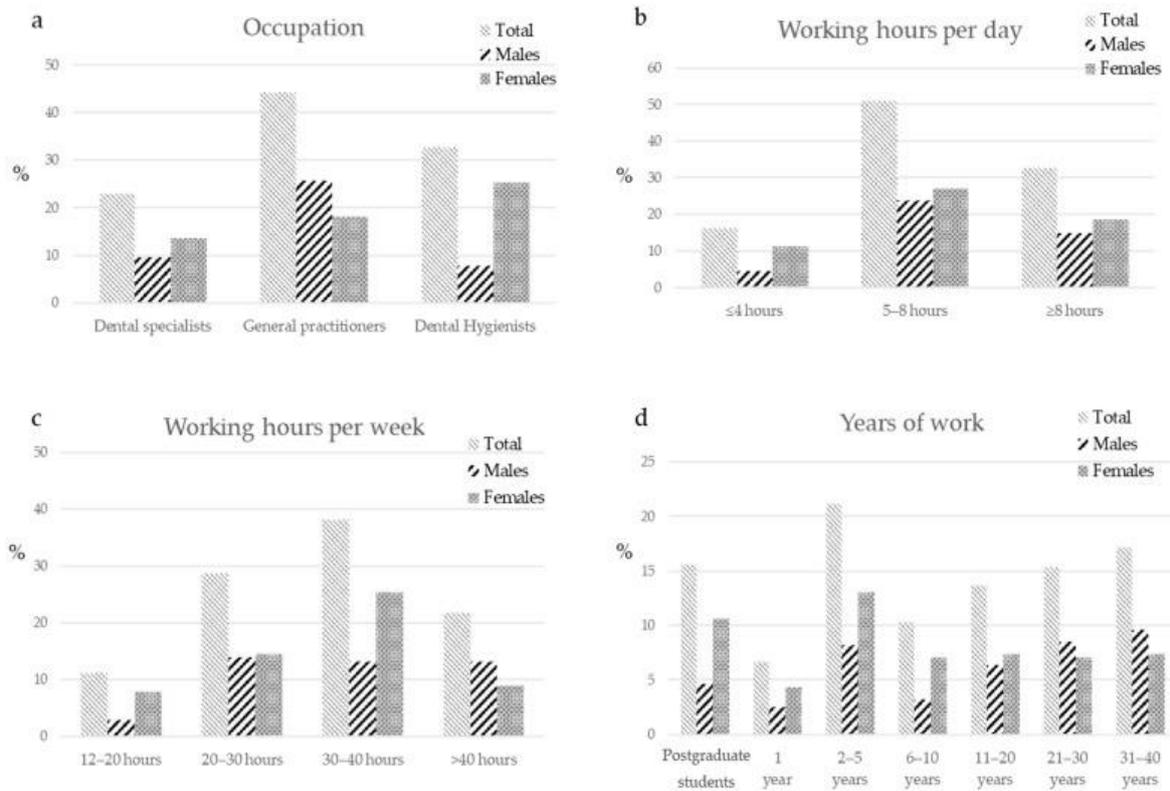
of WMSD, the *p*-values were 0.031 and 0.041, respectively.

Figure 4 reports the most frequent areas where WMSD occurred. The most affected areas resulted: neck (approximately 60%), lumbar region (52.1%), shoulder (43.3%), dorsal region (37.7%) and wrist (30.6%). Elbow, hip, knee and ankle were less frequently involved.

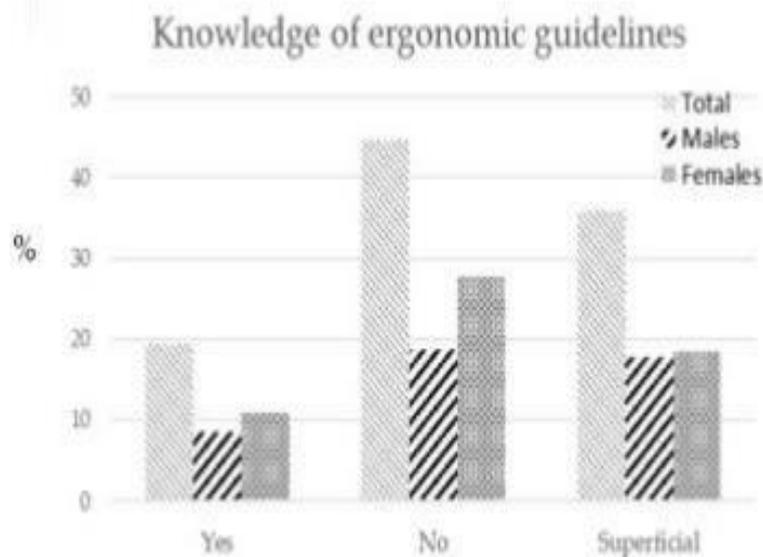
Figure 5 reports the distribution of WMSD that temporarily impeded the normal activity and daily routine in the last 12 months. Approximately 30% experienced this disability in the last 12 months.



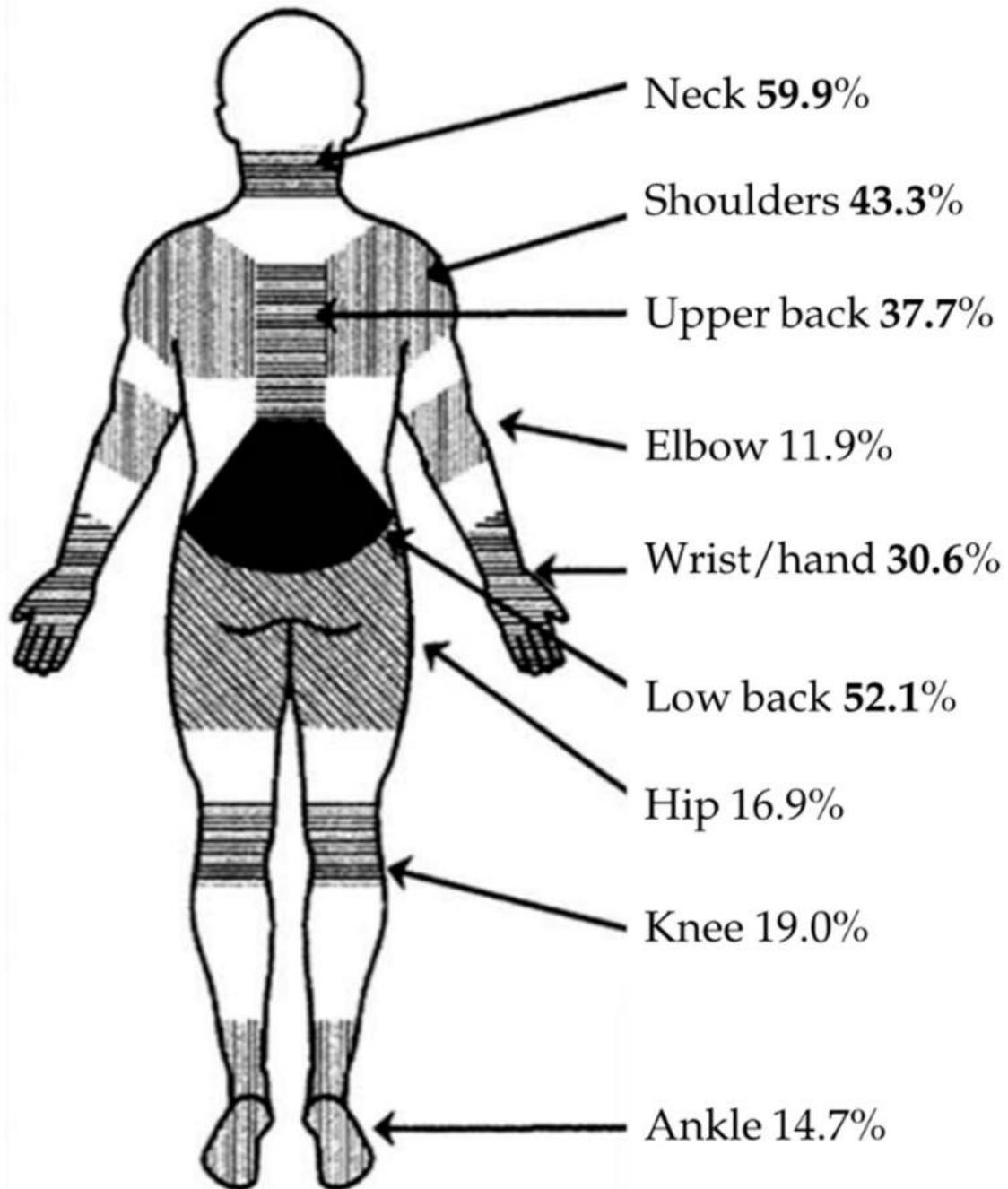
**FIGURE 1: Demographic distribution of the surveyed operators, expressed in percentages. (a) A higher percentage of females was found (57%). (b) Age of the operators was highly variable and comprises a high percentage of young dental professionals. In particular, over 50% of the participants were younger than 35 years (c) Over 70% of the surveyed professionals had normal weight and approximately 20% stated slight overweight. (d) The height was uniformly distributed with small groups of very tall and very short operators.**



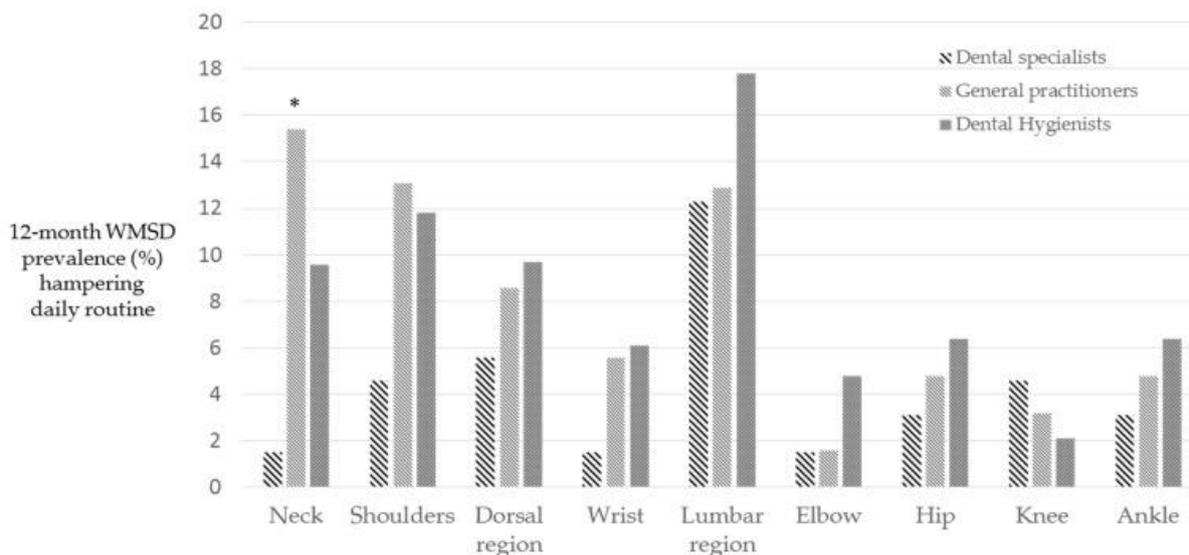
**FIGURE 2: Occupational distribution of surveyed operators, expressed in percentages. (a) The population was constituted by a higher percentage of general practitioners (approximately 50%), followed by dental hygienists (approximately 30%) and dental specialists (approximately 20%). (b) Most of the operators worked more than 5 h per day and (c) more than 30 h/week. (d) The years of work was uniformly distributed.**



**FIGURE 3: Lifestyle and knowledge of ergonomics of surveyed operators, expressed in percentages. Few operators (only 20%) declared a complete knowledge of the ergonomic guidelines, a total 35% had a superficial knowledge and more than 40% of surveyed operators did not know the guidelines.**



**FIGURE 4: Frequency of WMSD and distribution according to body regions.**



	Dental specialists	General practitioners	Dental Hygienists
Neck	1.5	15.4	9.6
Shoulders	4.6	13.1	11.8
Dorsal region	5.6	8.6	9.7
Wrist	1.5	5.6	6.1
Lumbar region	12.3	12.9	17.8
Elbow	1.5	1.6	4.8
Hip	3.1	4.8	6.4
Knee	4.6	3.2	2.1
Ankle	3.1	4.8	6.4

FIGURE 5: WMSD that temporarily hindered or modified dental work and daily routine in the last 12 months. Asterisk indicates statistically significant differences ( $p < 0.05$ )

TABLE 1: Work-related musculoskeletal disorders (WMSD) prevalence in surveyed operators. A high number of dental professionalssuffered from WMSD in the last 12 months.

TABLE 1	Absence (%)	Presence (%)
WMSD in the last 12 months	15.1	84.9
WMSD hampering the daily routine in the last 12 months	69.9	30.1
WMSD in the last 7 days	57.1	42.9

TABLE 2: WMSD in relation to knowledge of ergonomic guidelines (statistical significance for  $p < 0.05$ ). All these parameters were not statistically significant ( $p > 0.05$ ).

TABLE 2		Absence of WMSD			Presence of WMSD			X <sup>2</sup> test	
		Total (%)	Males (%)	Females (%)	Total (%)	Males (%)	Females (%)	Males/females	Total/total
Ergonomic knowledge	yes	12.7	100	0	87.2	35.4	64.6	$p=0.243$	$p=0.660$
	no	17.3	40.9	59.1	82.7	36.2	63.8		
	superficial	13.7	57.1	42.9	86.3	47.7	52.3		

TABLE 3: Logistic regression of factors in association to WMSD. (statistical significance for  $p < 0.05$ ). Gender and working hours per day parameters were significantly correlated to WMSD occurrence.

	Standard Error	coefficient	p-value	95.0% CI	
				Upper boundary	Lower boundary
Intercept	0.491	0.637	0.197	-0.332	1.606
Gender	0.070	0.152	0.031	0.014	0.289
age	0.025	0.035	0.163	-0.014	0.084
Body fatness	0.050	0.078	0.126	-0.022	0.177
height	0.031	0.018	0.557	-0.043	0.080
occupation	0.007	-0.006	0.398	-0.019	0.007

Working hours per day	0.056	0.115	0.041	0.005	0.226
Working hours per week	0.040	-0.025	0.544	-0.104	0.055
Years of work	0.014	0.016	0.251	-0.012	0.044
Ergonomic knowledge	0.036	0.025	0.491	-0.046	0.095

## DISCUSSION

This study examined the prevalence of WMSD among Nashik dental care workers, comprising dental specialists, general practitioners and dental hygienists. To the best of our knowledge, this is the first study on the dental professionals in Nashik.

In the present study, a positive correlation was noted between the number of patients treated per day and the occurrence of MSD, where the dental professionals who treated more than five patients per day were at a higher risk of developing musculoskeletal pain.

A recent Cochrane study highlighted the lack of physical, cognitive and organizational ergonomic interventions for preventing WMSD in dental care practitioners.<sup>5</sup>

As main result, this investigation revealed that the prevalence of WMSD in the past 12 months was 84.9%. Other previous studies showed a prevalence of 81.4% among 204 Brazilian dentists<sup>6</sup>, of 87.2% among 285 Australian dentists<sup>7</sup>, of 86.5% among 2449 dentists in Lithuania<sup>8</sup> and of 85.6% among 288 dentists in China.<sup>9</sup>

Other studies showed a higher prevalence, namely 94% among 120 dentists in Turkey<sup>10</sup>, 92% among 450 dentists and dental students in Germany<sup>6</sup>, 96% among 581 dentists in Czech Republic<sup>11</sup> and 95% among 80 dentists in Cameroon.<sup>12</sup>

WMSD hindered working activity in the last 12 months in approximately 30% of the investigated operators. One or more WMSD that affected their daily routine, temporarily impeding the outpatient activity. This result confirms the data from a recent review reporting that 1/3 of the dentists had to change their work activity and that 2/3 have suffered from WMSD at least once.<sup>13</sup>

Pain scores were relatively less in participants using lighter instruments with wide diameter.<sup>14</sup>

Direct view method for line of vision for tooth preparation, effect the lower back, shoulders, and neck of the dentist. Hence, correct use of line of vision prevents WMSDs among dentists.<sup>15</sup>

In one study, the therapeutic effect of yoga on psychological and physical ailments among dental interns aged between 21 to 24 years was evaluated using a pretest questionnaire, followed by yoga training for a month after which they were subjected to a post-test questionnaire assessing the levels of stress and relief from musculoskeletal ailments. Yoga training has significantly improved the quality of life among dental interns and WMSDs were reduced.<sup>16</sup>

The cervical spine is the most exposed area to develop WMSD, and mainly due to posture of dental operators working with the head tilted forward for more than 15–20°, resulting in an overload of muscles of the neck and joints of the cervical spine. In this position, posterior neck muscles (the neck extensors) work harder to hold the neck against gravity, provoking muscles tightening and leading to neck pain. This condition also affects the cervical lordosis curve. The muscles of the cervical and upper thoracic spine have to contract constantly to support the weight of the head. Loss of the cervical lordosis can cause pain, functional disabilities and disc protrusion. No differences by gender were observed when considering this body region. These data are different from that of previous studies, where females had higher percentages of WMSD in the neck than males.<sup>6,11</sup>

A high percentage (84%) of dental professionals had a partial (38%) or no (46%) knowledge of ergonomic guidelines. However, this condition is not related with WMSD onset. We may speculate that the occurrence of WMSD brought the interest to study and apply the ergonomics guidelines.

There is an urgent need to improve teaching dental ergonomics, through new pedagogical strategies, approaches and active learning methodologies. Comprehensive theoretical and practical training regarding ergonomic principles is worth being introduced in dental schools before the clinical training to prevent the occurrence of WMSDs.<sup>17</sup> Another study suggested the taught and training of ergonomic principles along with periodic evaluations reduces the prevalence of MSD among dentists.<sup>18</sup>

## CONCLUSION

There is an urgent need to intervene in this problem of WMSD as the numbers and stats show such significant rise in these disorders in dentists especially the experienced ones. The awareness among them regarding ergonomic knowledge and practices is also very less which is the area that needs to be worked on by conducting courses and seminars.

The awareness of practicing healthy attitudes and the fostering of attention to the signals and needs of the body are suggested as new pedagogical approaches to increase body and mind well-being and to improve the achievement of a pleasing long profession.

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The study was approved by the Institutional Ethics Committee

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