

## Prevalence of Work-related Musculoskeletal Disorders in Orthodontists of Gujarat amidst COVID-19 Era

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### Abstract

**Objective:** The objective of the study was to find out the prevalence and severity of the work-related musculoskeletal disorders (WMSDs) among orthodontists of Gujarat. Furthermore, to evaluate the impact of the COVID-19 pandemic on the pre-existing Work-Related Musculoskeletal Disorders among Orthodontists.

**Material and methods :** A cross-sectional online survey was carried out using a 33-item questionnaire which were divided into 2 sections on the basis of the study time interval; Annexure A contained questions pertaining to Pre-covid period and Annexure B contained questions targeting a time period after the emergence of the COVID 19 pandemic. The google forms were used to collect data and were distributed via a social media platform(WhatsApp), A self-assessment scale with a pain severity score from 0 to 3 was used to objectively assess the subjective symptoms of pain. Also a comparison was drawn between the pre and post COVID era in terms of WMSD condition, type of clinical practice conducted and life style changes implemented by the orthodontists .

**Results :** The sample consisted of 90 orthodontists (31 females and 59 males) with  $\geq 10$  years of clinical experience post MDS who were into active clinical orthodontic practice in Gujarat .It was categorized into two groups based on the years of clinical experience :1) T1 group = 10-20 years(n=53){age group=35-45 years} and 2)T2 group= more than 20 years of experience(n=37){age group >45 years}. Majority of the surveyed orthodontists (91%) were found to be suffering from WMSD; those in T1 group were found to be more affected than T2 group. Most common areas affected by WMSDs were neck and lower back. COVID-19 lockdown period did not play major role in changing WMSD severity.

**Conclusion:** High prevalence of WMSDs exists among orthodontic practitioners of Gujarat. A higher incidence of pre-existing WMSD conditions were found in the T1 group inspite of inculcating more physical daily exercises into their routine. More focus needs to be given to the orthodontists especially in younger age group(<45 years) in terms of early management of WMSDs as well as for implementation of ergonomic principles into their orthodontic practice.

**Key words:** Work-related Musculoskeletal disorders; WMSDs; Prevalence; Orthodontists; Gujarat; COVID-19; Musculoskeletal disorder.

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### I. Introduction

Musculoskeletal Disorder (MSD) is defined by the World Health Organisation (WHO) as: “a disorder of muscles, tendons, peripheral nerves or vascular system not directly resulting from an acute or instantaneous event (e.g., slips or falls). These disorders are considered to be work-related when the work environment and the performance of work contribute significantly, but are only one of a number of factors contributing to the causation of a multifactorial disease. <sup>1</sup> According to studies, dentists typically report a higher incidence, more frequent and worse MSD defects than any other high risk medical professionals<sup>2,3</sup>. This is due to the nature of dental work as dentists are more exposed to abnormal postures as part of their occupation, having to use heavy forces in repetitive movements which could acts as risk factors for MSD.

The overall prevalence of musculoskeletal disorders in dentistry ranges from 63 to 93 % worldwide<sup>4,5</sup>. The number and type of WMSDs(Work-related Musculoskeletal Disorders) present among dental practitioners and orthodontists was found to be much higher in different parts of the world<sup>6-12</sup> compared to 40% prevalence found in Indian orthodontists<sup>6</sup>. Also, WMSDs were found to be significantly higher in groups with 5 to 10 years of work experience and in those above 10 years of experience<sup>6</sup>.

COVID-19 emerged worldwide as a prodigious event in December 2019, which has led to potentially severe unprecedented consequences in almost all realms of life, not sparing Dentistry including Orthodontics. The pandemic has led to a drastic change in the work environment for orthodontists, and it is the need of the hour to adapt to the change, adopt the newer protocols, and be adept in the same<sup>13</sup>. Moreover, with the onset of the COVID-19 pandemic, the extended use of additional protective devices such as personal protective equipment (PPEs), face shield, N-95 mask and respirators, newer disinfecting and sterilization procedures could increase the overall work stress, risk of imbalanced postures and could further reduce the freedom of movements while practicing in dentistry, thus adding greater physical and psychological burden among dental professionals.

COVID-19 was first reported in Gujarat, India in March 2020; the Government of India announced a 21-day nationwide lockdown on March 25, 2020, which had been extended till 30th May with progressive changes in restrictions with time<sup>14</sup>. On 11<sup>th</sup> May 2020 the Ministry of Home Affairs wrote to all states to remove restrictions on the movement of medical professionals and to allow the reopening of private clinics and nursing homes. Hence with the easing of restrictions many private dental clinics and Institutes reopened and few Orthodontists started to resume their orthodontic practice in Gujarat and nationwide.

With above mentioned information in mind, it was initiated to know the effect of WMSDs among orthodontists of Gujarat. Also, due to a lack of data available on the prevalence of WMSDs among the Orthodontists of Gujarat, it seemed necessary to conduct a study to evaluate the prevalence of WMSDs among these professionals. Keeping in mind the emergence and effect of the COVID-19 pandemic, it was thought worthwhile to also evaluate the impact of the pandemic on the pre-existing Work-Related Musculoskeletal Disorders among Orthodontists.

#### **OBJECTIVES :**

- 1) Prevalence and severity of Work-Related Musculoskeletal Disorders among Orthodontists in Gujarat.
- 2) Effect of ergonomics on Work-related Musculoskeletal Disorders.
- 3) Effect of COVID-19 pandemic on pre-existing Work-Related Musculoskeletal Disorders.

## **II. Material And Methods**

A cross-sectional descriptive study was conducted in Gujarat, India to assess the prevalence of WMSDs among orthodontic practitioners amidst COVID-19 era. The study protocol was reviewed and approved by the Institutional Review Board of the dental college. Inclusion criteria was set to incorporate only those Orthodontists having  $\geq 10$  years of clinical experience Post MDS and who had been routinely involved in active clinical orthodontic practice till February 2020. Those Orthodontists who had discontinued their clinical practice before February 2020 were excluded from the study.

Pre-testing of the study questionnaire consisting of 27 questions was conducted. A panel of two qualified MDS faculty in the college screened and reviewed the questionnaire which was then administered to 12 MDS practitioners who were actively involved in routine clinical practice in the institute. These 12 pre-testers were asked to respond to the questionnaire and place their comments, critiques, as well as give their suggestions in writing. The responses were then discussed by the panel members and improvisations were made in the study questionnaire on the basis of the feedback obtained. The Pre-testers were excluded from the main study to avoid any bias.

Contact details as well as Email addresses of 180 Orthodontists practicing in Gujarat was obtained from the records of the Gujarat Orthodontic Study Group (GOSG), out of which a total of 90 orthodontists who sufficed the inclusion criteria were sent an invitation link of the online study questionnaire (using google forms) via social media platform (WhatsApp). Those orthodontists who did not respond were contacted again after a period of 15 days and were motivated to fill the questionnaire form. Thus, total of 90 participants who filled and submitted the questionnaire were included in the study and the data was then subjected to analysis. The study questionnaire included 33 compulsory close ended questions which were divided into 2 sections on the basis of the study time interval.

1. Annexure A – contained questions pertaining to a time period between February 2019 -February 2020 (Before the advent of the COVID-19 pandemic)
2. Annexure B- contained questions targeting a time period between May 2020-November 2020 (After the emergence of the COVID-19 pandemic)

The online questionnaire form included single response option as well as multiple select checkbox options. The questionnaire was aimed to focus on the duration and type of clinical practice, ergonomics during clinical practice, the presence and nature of MSDs among orthodontists, life style changes since the advent of COVID-19 pandemic, as well as the impact of the pandemic on the pre-existing WMSDs. The recorded data was analysed using the Statistical Package for Social Sciences (SPSS) software version 17 and Chi square test was used for statistical analysis. Level of significance was set at  $p \leq 0.05$ .

Questionnaire form : Demographic details and Annexure A

**PREVALENCE OF WORK-RELATED MUSCULOSKELETAL DISORDERS IN ORTHODONTISTS OF GUJARAT AMIDST COVID 19 ERA**

**QUESTIONNAIRE FORM**

**DEMOGRAPHICS**

Email ID:  
Age:  
Gender:  
Height(in cm):  
Weight(in kg):  
Years of clinical practice(Post MDS orthodontics):

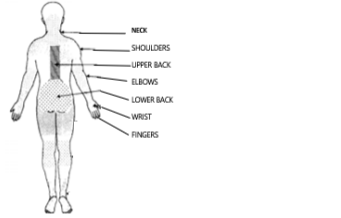
**ANNEXURE A**

THE FOLLOWING QUESTIONS ARE DIRECTED SPECIFICALLY TOWARDS YOUR CLINICAL PRACTICE BEFORE THE BEGINNING OF COVID-19 PANDEMIC (PRE COVID-19 -BETWEEN FEB 2019 -FEB 2020)

- I have been routinely practicing during the period between FEB 2019 -FEB 2020  
 Yes  No
  - Average no. of hours of clinical practice per day  
 <2-hours  3-5hours  6-8hours  >8 hours
  - Average number of patients you see on a daily basis? \_\_\_\_\_
  - Average amount of time (min/hr) spent per patient per appointment? \_\_\_\_\_
  - How do you predominantly work in clinical practice?  
 Standing  Sitting  Both
  - Which hand do you predominantly use while working on patients?  Right  Left
  - Total number of bonding done per month? out of which no. of indirect bonding done per month? \_\_\_\_\_
  - Do you consciously/subconsciously follow ergonomic principles of operator's position, patient position, and dental chair position while treating patients in the dental office?  
 Yes  No
- If the answer to your above Question 8 is 'NO', thinking consciously (select all that apply)
- Your head is positioned too forwards
  - Your shoulders are rounded

- You lean forward at the lower back
- Other \_\_\_\_\_

9) Have you ever suffered from work-related musculoskeletal pain?  
If "YES", please select the area/areas affected. Select all that apply (either right/left or both sides)



	Neck	Shoulder	Upper back	Lower back	Elbow	Wrist	Fingers
Yes	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
No	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

10) Please write scores of your pain/discomfort you have experienced in a particular body part/area according to the grading provided.

	0	1	2	3
Neck	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Upper back	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Elbow	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Lower back	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Wrist	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Fingers	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Shoulders	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

11) Have you had any extended break periods from clinical practice due to musculoskeletal pain / disorders?  
 Yes  No  
If "YES", please mention the duration of break period \_\_\_\_\_

12) Do you think your musculoskeletal pain could be due to improper posture while treating patients and/or due to non-ergonomically designed equipments?

	Yes	No
Improper posture	<input type="checkbox"/>	<input type="checkbox"/>
Non-ergonomically designed equipm...	<input type="checkbox"/>	<input type="checkbox"/>

13) Do you consciously try to take rest breaks between appointments?  Yes  No  
If "YES", please write the average time spent for rest breaks. \_\_\_\_\_

- 14) Do you do any of the following to reduce MSDs during/after clinical hours?
- Do nothing about it
  - take more than usual amount of recovery breaks/rest breaks
  - take more than usual amount of relaxation exercises
  - practice meditation
  - prescription/nonprescription medications
  - other \_\_\_\_\_

15) Have you had any accident/injury or pre-existing condition that could have pre-disposed into developing work-related musculoskeletal pain?  Yes  No  
If "YES" please specify the type/nature of injury and body part affected by the same. \_\_\_\_\_

16) Do you have any pre-existing medical condition?  Yes  No  
If "YES", please mention \_\_\_\_\_.

17) Have you implemented any lifestyle changes to reduce your MSD related pain?  
 Yes  No  
If "YES", tick any/all that apply  
 Exercises  Yoga  Meditation  Running  Walking  Sports activities  
 Cycling  Dieting/obesity management  Any other \_\_\_\_\_

18) Do you exercise regularly?  Yes  No  
If "YES" please specify minutes or hours /day \_\_\_\_\_

Questionnaire form: Annexure A

**ANNEXURE B**

**THE FOLLOWING QUESTIONS ARE DIRECTED SPECIFICALLY TOWARDS YOUR CLINICAL PRACTICE AFTER THE BEGINNING OF COVID-19 PANDEMIC (BETWEEN MARCH 2020 -NOVEMBER 2020)**

19) I have resumed my practice since the Government imposed Covid-19 lockdown in Gujarat was lifted May 2020 onwards?

Yes  No

If No, what was the probable reason for the same?

coronaphobia

pre-existing medical condition

as advised by physician

co-morbid conditions

others

20) Did you gain weight during lockdown?(March2020-May2020)

Yes  No

21) Have you implemented any lifestyle changes to reduce your MSD related pain during the lockdown? (March2020-May2020)

Yes  No

If "YES" tick any/all that apply

Exercises  Yoga  Meditation  Running  Walking  Sports activities

Cycling  Dieting/obesity management  Any other \_\_\_\_\_

22) Do you exercise regularly?  Yes  No

If "YES" please specify minutes or hours/day: \_\_\_\_\_

23) Have you noticed any changes in musculoskeletal pain after you started your practice again post lockdown (May-Nov 2020)?

Increased  Decreased  Remained same

If increased/decreased in Question 5, then according to you what possibly could have been the probable reason for it: \_\_\_\_\_

24) Average number of patients you see on a daily basis? \_\_\_\_\_

25) Average amount of time spent(min/hrs) per patient per appointment? \_\_\_\_\_

26) Do you consciously try to take rest breaks between appointments?  Yes  No

If "YES", please write the average time spent for rest breaks. \_\_\_\_\_

27) Do you think that additional efforts and time required for procurement of personal protective equipment (PPE), management, setting up new sterilization protocols has increased since the Covid 19 pandemic

Yes  No

If "YES" average time spent for the same \_\_\_\_\_ (excluding clinical practice hours and break time)

Thank you for your time and participation

Questionnaire form: Annexure B

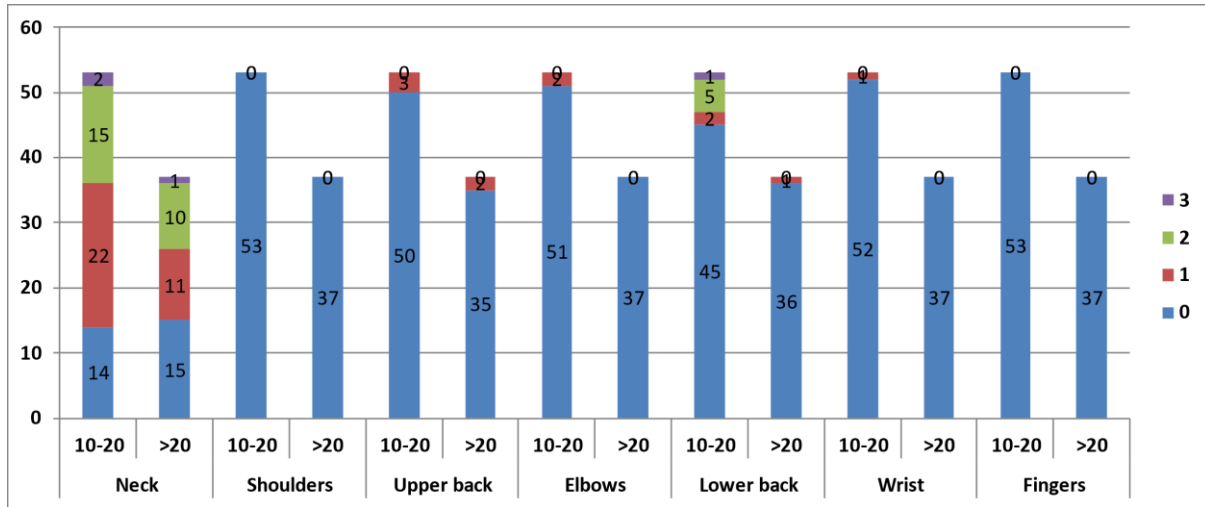
### III. Results

**Table 1:** Clinical practice of the Orthodontists before the advent of COVID-19(Feb 2019- Feb 2020)

Variable		Years of Experience			
		10-20 (n=53)	>20 (n=37)		
Routinely practicing between Feb-19 to Feb-20	Yes	100%(53)	100%(37)		
	No	0	0		
Average number of hours of clinical practice per day	2-3 hours	8%(4)	11%(4)		
	3-5 hours	19%(10)	30%(11)		
	6-8 hours	57%(30)	51%(19)		
	>8 hours	17%(9)	8%(3)		
Type of clinical practice	Standing	2%(1)	3%(1)		
	Sitting	64%(34)	76%(28)		
	Both	34%(18)	22%(8)		
Hand predominance	Right	85%(45)	92%(34)		
	Left	15%(8)	8%(3)		
Bonding per month	Mean±SD	12.32±6.92	10.95±7.28		
		<b>PRE COVID</b>	<b>POST COVID</b>	<b>PRE COVID</b>	<b>POST COVID</b>
Average number of patients seen on a daily basis	1-10	45%(24)	62%(33)	54%(20)	65%(24)
	11-20	43%(23)	32%(17)	35%(13)	24%(9)
	21-30	8%(4)	4%(2)	5%(2)	5%(2)
	>30	4%(2)	2%(1)	5%(2)	5%(2)
Average amount of time (min/hrs)spent per patient per appointment	<15 min	6%(3)	11%(6)	3%(1)	5%(2)
	15-30 min	92%(49)	81%(43)	92%(34)	81%(30)
	>30 min	2%(1)	8%(4)	5%(2)	14%(5)
Rest between appointments	Yes	28%(15)	11%(6)	41%(15)	16%(6)

	No	72%(38)	88%(47)	59%(22)	83%(31)

**Table 2:**Prevalence of WMSDs in Orthodontists



**Table 3:** Ergonomic principles practiced by the Orthodontists

Variable		Years of Experience	
		10-20 (n=53)	>20 (n=37)
consciously/subconsciously follow ergonomic principles	Yes	38%(20)	68%(25)
	No	62%(33)	32%(12)
If Not then,	head is positioned too forward	30%(16)	19%(7)
	shoulders are rounded	8%(4)	3%(1)
	lean forward at the lower back	24(45)	4(11)
	Twisting	2(4)	0

**Table 4:** Causative factors for WMSDs in Orthodontists

Variable		Years of Experience	
		10-20 (n=53)	>20 (n=37)
Could musculoskeletal pain be due to improper posture while treating patients and/or due to non-ergonomically designed equipments?	Yes	83%(44)	33(89)
	No	17%(9)	11%(4)
Improper posture	Yes	85%(45)	68%(25)
	No	15%(8)	32%(12)
Non-ergonomically designed equipment	Yes	53%(28)	35%(13)
	No	47%(25)	65%(24)

**Table 5:** Remedial measures undertaken for relieving WMSD pain by the Orthodontists

Remedial measures	Years of Experience	
	10-20 (n=53)	>20 (n=37)
Do nothing about it	36%(19)	27%(10)
Take more than usual amount of recovery breaks/rest breaks	19%(10)	5%(2)
Take more than usual amount of relaxation exercises	43%(23)	49%(18)
Practice meditation	13%(7)	19%(7)
Prescription/nonprescription medications	15%(8)	27%(10)

Others	2%(1)	5%(2)
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**Table 6:** Non-work related MSDs present in Orthodontists

Variable		Years of Experience	
		10-20 (n=53)	>20 (n=37)
Any accident/injury or pre-existing condition that could have pre-disposed into developing work-related MSD pain	Yes	11%(6)	3%(1)
	No	89%(47)	97%(36)
If yes, specifications of the type of injury	Disc Prolapse T3-T4	2%(1)	0
	Lower back	6%(3)	3%(1)
	Less muscle tone on right leg	4%(2)	0

**Table 7:** Exercise regime of the Orthodontists in the Pre and Post Covid-19 Era

Variable		Years of Experience				P Value
		10-20 (n=53)		>20 (n=37)		
		PRE COVID	POST COVID	PRE COVID	POST COVID	
Exercises done regularly	Yes	72%(38)	79%(42)	84%(31)	86%(32)	>0.05
	No	28%(15)	21%(11)	16%(6)	14%(5)	
If yes,time frame(minutes)	(Mean±SD)	35.53±16.47	35.71±18.16	37.09±17.07	37.19±17.17	>0.05

**Table 8:** Life style changes implemented by the Orthodontists in Pre and Post COVID-19 Era

Variable		Years of Experience			
		10-20 (n=53)		>20 (n=37)	
		PRE COVID	POST COVID	PRE COVID	POST COVID
lifestyle changes implemented to reduce MSD related pain	Yes	87%(46)	70%(37)	76%(28)	68%(25)
	No	13%(7)	13%(16)	24%(9)	32%(12)
If yes(Multiple answer)	Exercise	53%(28)	38%(20)	51%(19)	49%(18)
	Yoga	38%(20)	28%(15)	35%(13)	35%(13)
	Meditation	28%(15)	9%(5)	14%(5)	19%(7)
	Running	15%(8)	8%(4)	3%(1)	3%(1)
	Walking	51%(27)	40%(21)	41%(15)	24%(9)
	Sport activity	17%(9)	8%(4)	11%(4)	0
	Cycling	13%(7)	8%(4)	5%(2)	5%(2)
	Dieting/Obesity	21%(11)	21%(11)	14%(5)	24%(9)
	Other	0	0	0	0

**Table 9:** Clinical practice of the Orthodontists Post Covid-19(May 2020-Nov 2020)

Variable		Years of Experience	
		10-20 (n=53)	>20 (n=37)
Resumed practice after lockdown	Yes	96%(51)	95%(34)
	No	4%(2)	8%(3)
If No, probable reasons	Coronaphobia	1	1
	pre-existing medical condition	0	1
	as advised by physician	1	1

	co-morbid conditions	0	1
Additional efforts and time required for procurement of PPE, management and setting up new sterilization protocols has increased since the Covid 19 pandemic	Yes	89%(47)	84%(31)
	No	6(11%(6)	6(16%(6)

**Table 10:** Post Covid severity changes in WMSD pain

Variable		Years of Experience	
		10-20 (n=53)	>20 (n=37)
Changes in WMSD pain after resuming practice post lockdown.	Increased	45%(24)	28%(11)
	Decreased	9%(5)	5%(3)
	Remained same	45%(24)	67%(24)

#### IV. Discussion

A cross-sectional questionnaire study was conducted to evaluate the prevalence of Work-related Musculoskeletal Disorders(WMSDs) among Orthodontists practicing in Gujarat. Keeping in mind the emergence and effects of the COVID-19 pandemic on a national level , this study also aims to evaluate the impact of the pandemic on the pre-existing Work-related Musculoskeletal Disorders among the Orthodontic practitioners.

The study highlights and supports an already pre-established fact that WMSD is a major concern for the overall health and wellbeing of orthodontists<sup>22</sup>. A sample consisting of 90 orthodontists (31 females and 59 males)with  $\geq 10$  years of clinical experience post MDS who were into active clinical orthodontic practice in Gujarat were considered to be included in the study. The sample was then categorized into two groups based on the years of clinical experience :1) T1 group = 10-20 years(n=53){age group=35-45 years} and 2)T2 group= more than 20 years of experience(n=37){age group >45 years} .

The present study shows very high (100%) response rate as all the 90 orthodontists falling into inclusion criteria voluntarily filled out the survey which was sent to them. Similar study done by Newell and Kumar<sup>10</sup> showed only 52.4% response rate out of 61 orthodontists approached, although this rate is considered to be adequate according to Diem which can lead to better results<sup>15</sup>.

The study instrument used was a Nordic questionnaire<sup>16</sup>, which records musculoskeletal symptoms and screens for MSDs in an ergonomic context. It serves as a diagnostic tool for analysing the work environment and identifying incompatibilities in the working environment of the orthodontic practitioners. A self-assessment scale was used to measure the severity of MSD pain, and participants had to score their pain as per severity of their condition. Pain severity score was as follows: 0= no pain, 1= mild pain, 2=moderate pain, 3= severe pain. This scale can help to objectively assess the subjective symptoms of pain.

A staggering 90% participants in the survey acknowledged that they had been suffering from some form of a work-related musculoskeletal disorder. Furthermore, this prevalence was found to be more among the orthodontists in T1 group (96%) as compared to T2 group (78%) .This could be attributed to a better understanding of the ergonomic principles by older practitioners(T2 group), as well as implementation of these principles into their routine clinical practice . Similar findings were observed during a study conducted by Abduljabbar and Marshall et al. in Saudi Arabia and New South Wales who revealed that MSD decreases with age<sup>17,18</sup>.Contrasting to this, many studies conducted previously have shown that musculoskeletal disorders increase with advancing age.<sup>19-23</sup>

According to Kierklo et al., number of years of practice can play an important role in the occurrence of MSDs.<sup>21</sup> The years of work experience has been significantly associated with increasing disorders of the musculoskeletal system.<sup>19,24-27</sup> . The present study focused on each practitioner’s number of years in clinical practice post MDS as a basis for comparison and statistical models were adjusted according to their years into clinical practice. It was found that the practitioners in T1 group with >20 years of clinical experience have a higher prevalence of musculoskeletal disorder .Similar findings were seen in a study conducted to evaluate prevalence of MSD in dentists by Leggat and Smith , Finsen et al .showed that MSD pain was negatively correlated with experience years.<sup>28,29</sup> Thus it can help us to conclude that with increasing in age there is a better understanding and emphasis put on implementation of ergonomics into practice which helps in controlling WMSDs.

Body mass index (BMI), which is a measure of body adiposity and is described as the weight (kg) divided by height (m<sup>2</sup>), is also known to be related to the development of MSDs<sup>30</sup> and can play a role in the development of this condition. In the present study 42% of the total sample population had a higher BMI and

were found to be either overweight or obese which could be a possible cause for the presence of the underlying MSD condition.

The COVID-19 (SARS COV-2) pandemic outbreak has redefined the way in which dentistry, more specifically Orthodontics is practiced in the recent times. The practitioners are subjected to a different work schedule with fewer, more spaced-out patient appointments, newer sterilization protocols, more expensive yet less comfortable Personal protective equipment (PPE) wear along with a lesser overall revenue.<sup>13</sup> This could lead to mental as well as physical stress for the orthodontists which could possibly have a serious impact on their pre-existing health conditions. With this in mind, the study also objectively aimed to analyse the impact of COVID-19 on the pre-existing WMSDs, as well as draw a comparison between the pre and post COVID era in terms of WMSD condition, type of clinical practice conducted and life style changes implemented by the orthodontists.

The results show that before the advent of COVID-19 pandemic, the Orthodontists in Gujarat were working 6 to 8 hours on an average and treating 10-15 patients per day with 15-30 min time spent on an average by both T1 and T2 groups (Table no.1). Finsen et al. and Chowanadisai et al. have shown a positive correlation between longer appointment length with musculoskeletal pain among dentists.<sup>29,31</sup> Since the emergence of COVID-19 pandemic, this number has reduced drastically (Table no.1) and the time taken per appointment has been increased, although not statistically significant. This finding can be attributed to the period of lockdown imposed by the government as well as the decrease in the patients visiting the clinics due to the pandemic. Only 5 out of 90 orthodontists did not resume their practice post lockdown due to coronaphobia, pre-existing medical conditions and co-morbidities or as advised by physicians (Table no.9). This shows that COVID 19 was not a deterrent factor for 94.4% orthodontists for reopening of their clinics.

Around 87% of the practitioners in the study were right handed, 68% of the orthodontists were practicing sitting dentistry, with a 28% practicing combination of both standing and sitting dentistry. Ratzon et al<sup>4</sup> found a significant correlation between length of time spent sitting and severity of low back pain among dentists. Shugars et al<sup>32</sup> found that general dentists who spent 80-100% of the time practicing while seated reported more frequent low back pain than dentists who would stand more while practicing. Interestingly, Lalumandier et al<sup>33</sup> also found that oral and maxillofacial surgeons who spent the most hours standing of all dental professionals reported twice as much leg pain than general dentists, and ultimately recommended incorporating as much variety as possible into daily postural habits. Also physical postural issues may become increasingly relevant for orthodontists practicing the indirect bonding technique. 6 out of 90 orthodontists in the present study practiced indirect bonding technique, while average bonding done by orthodontists of T1 group was found to be 12.32±6.92 and 10.95±7.28 in T2 group (Table no.1).

Studies carried out by Newell and Kumar<sup>10</sup> and Lalumandier<sup>33</sup> have found the areas of most pain to be more consistent among dentists and orthodontists, with back pain being the most prevalent followed by neck and shoulder pain. Also neck and back have been found to be the common sites for MSDs as dentists do a large part of their work with their head bent forward and rotated and with their arms, especially the right one, held out from the body. This working posture leads to a considerable load on different structures in the neck, back and shoulders.<sup>34</sup>

In present study, Neck (67.7%) and lower back (66.6%) were found to be the most commonly affected regions (Table no.2), these findings were similar to a study conducted by Ayers et al. on a study population based in New Zealand<sup>35</sup>, which showed a high prevalence of MSD among general dental practitioners regardless of their qualification and specialty and the prevalent site affected was found to be low back and neck. A lower incidence of musculoskeletal problems were found in upper back (30%), shoulder (24.4%), fingers (16.6%), wrist (15.5%) and elbow (4.4%) regions (Table no. 2).

Pain in the back, neck, shoulders and upper limbs has been associated with awkward postures as these typically result in cervical flexion, unsupported elevation of the arms and specific, strength-demanding hand movements<sup>36</sup>. In the present study 50% orthodontists were aware that they were not following ergonomic principles; their non-ergonomic postures included leaning forward at lower back, positioning head too far forward as well as rounded shoulders and twisting (Table no.3). The forward-head-and-rounded-shoulder posture increases forces on the upper neck muscles leading to pain in neck and repeatedly leaning toward a patient can cause strain and overexertion in the low back extensors, while the deep stabilizing abdominal muscle (transversus abdominus) tends to become weaker which could cause pain in lower back.<sup>1</sup> Also a majority of the orthodontists in the present study agreed that their MSD is due to improper posture and non-ergonomically designed equipments (Table no.4). This would suggest that although orthodontists are aware that their posture is improper, enough attention is not paid to improvise on the same.

Exercise strengthens the muscles and increases the blood flow, oxygen and nutrient supply to muscle cells and prevents MSDs.<sup>24</sup> Our study reveals that 76.6% orthodontists were exercising regularly before the emergence of covid which increased to 82.2% after the advent of the pandemic (Table no.7). Prevalence and severity of various MSDs decreased by performing regular exercises among large group of dentists<sup>24</sup>. Greater importance on health in the COVID-19 era could be a causative factor for the increase in the number of orthodontists exercising regularly. Those orthodontists who exercised regularly also admitted to having a



presence of WMSD, suggesting that orthodontists who have an existing WMSDs were more likely to do so to alleviate their symptoms.

A healthy lifestyle including aerobic exercises or any form of physical activities may be performed three to four times a week for at least 20 minutes to improve the flow of nutrients and oxygen to the muscles.<sup>37</sup> In the present study 83% orthodontists have implemented life-style changes to reduce MSD related pain in form of exercise, yoga, meditation, sports activities, running, walking, cycling, dieting before covid , while 68.8% showed continuation of the same after the emergence of COVID-19(Table no.8).It seems that practitioners had utilized these life style changes as a means to alleviate WMSD, rather than employing it as a preventing measure.

Pre-existing MSD pain severity changed after the lockdown which was implemented due to the COVID-19 surge, as 38.8% orthodontists showed increased pain ,7.7% showed decreased pain and 53.33% showed no change at all (Table 10). Also an increase in work load and use of cumbersome PPE lead to an increase in pain (Table no.9).While for a few orthodontists the pain decreased as they were able to take out more time and focused more on their health during the lockdown period. Interestingly, despite the increase in the number of orthodontists exercising more post the COVID-19 emergence and also during the lockdown periods ,the WMSD pain severity mostly remained the same(Table no.10).As the lockdown period was only of 3 months it might have been insufficient for the orthodontists to recoup from their WMSD pain. Significant changes could have been seen had the life style changes ben implemented for a longer time period.

## **V. Limitations**

Although all the orthodontists practicing in Gujarat were included in the study, probably covering a larger geographical area could have yielded better results . Also psychological stress and leisure activities were not taken into consideration. Comparison of the prevalence and severity of WMSDs among younger (< 10 years of experience) and older Orthodontists could also be done.

## **VI. Conclusion**

The study reports a very high (90%) prevalence of Work-related Musculoskeletal Disorders among the orthodontists practicing in Gujarat having  $\geq 10$  years of clinical experience. The major risk factors for WMSDs which were identified are improper posture practiced while treating patients and lack of rest breaks taken in between appointments .Orthodontists with more clinical experience were found to be more aware of ergonomics and implemented these principles in their clinical practice. Neck and lower back were most commonly affected areas and the pain experienced was from mild to moderate in severity; only very few orthodontists reported severe pain.

Covid -19 has led to changes in the way Orthodontics is practiced now especially with respect to improved infection control and sterilization protocols. Although COVID-19 lockdown period did not play major role in changing WMSD severity, 3 months lockdown period where in the practice was suspended seemed too short time frame to evaluate any changes in the severity of WMSD pain. Mostly all the orthodontists resumed their practice immediately after the lockdown was Also, a large percentage of the respondents reported that additional efforts and time required for procurement of PPE, management and setting up new sterilization protocols has significantly increased since the advent of the Covid 19 pandemic.

Recommendations for prevention of WMSDs among orthodontists should include awareness about causative factors of WMSD such as improper posture, repetitious movements, physical loads, psychological stress, and other ergonomic factors ,as well as incorporating rest breaks between appointments .Implementation of life style changes that can aid in prevention of WMSD such as exercises, yoga, meditation, sports activities and outdoor activities can be followed.

A higher incidence of pre-existing WMSD conditions were found in the T1 group inspite of inculcating more physical daily exercises into their routine. Thus, more focus needs to be given to the Orthodontists especially in this younger age group( <45 years) in terms of early management of WMSDs as well as for implementation of ergonomic principles into their orthodontic practice.

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