

Musculoskeletal Disorders Complaints Among Dental Profession Students at the Educational Dental and Oral Hospital in Semarang, Central Java, Indonesia: A Descriptive Study

Anindita Dian Fitria¹, Dwi Windu Kinanti Arti², Diki Bima Prasetio³

¹Student, Bachelor of Dentistry, Faculty of Dentistry, Universitas Muhammadiyah Semarang, Semarang, Jawa Tengah 50273, Indonesia

²Faculty of Dentistry, Universitas Muhammadiyah Semarang, Semarang, Jawa Tengah 50273, Indonesia

³Faculty of Public Health, Universitas Muhammadiyah Semarang, Semarang, Jawa Tengah 50273 Indonesia

Email address: aninditadianfitria08@gmail.com

Abstract— Background: Musculoskeletal Disorders (MSDs) are common among dental profession students due to prolonged uncomfortable postures, repetitive movements, and high workloads. A preliminary study at the Educational Dental and Oral Hospital in Semarang found frequent complaints of neck, back, and hand pain. However, research on contributing factors remains limited. **Purpose:** This study aims to describe MSDs complaints among dental profession students. **Methods:** This cross-sectional study, conducted from in Januari-February 2025 involved 56 dental profession students selected through simple random sampling. Independent variables included age, gender, BMI, exercise duration, work duration, and knowledge of dental ergonomics, while MSD complaints were assessed using the Nordic Body Map (NBM) questionnaire. Ethical approval was obtained, and data collection involved informed consent and questionnaire interviews. Univariate analysis was performed using IBM SPSS Statistics 21. **Result:** Most participants were 23–24 years old, female, and had an ideal BMI. Moderate MSD complaints were common (82,1%), with higher risks in women, obese individuals, and those with low ergonomic knowledge. The back, waist, and right shoulder were the most affected areas, with extreme pain mainly in the back (5,4%). **Conclusion:** Most dental profession students experience moderate MSD complaints, especially females and those with over 12 months of work. Preventive strategies like ergonomic education, proper tools, rest, and exercise are essential to reduce risks,

Keywords— Musculoskeletal Disorders, Dental Students, Ergonomics, Posture and Hospital.

I. INTRODUCTION

Musculoskeletal Disorders (MSDs) are disorders of soft tissues caused by unergonomic working postures, repetitive movements, and high force use without adequate rest¹. This disorder often occurs in areas of muscles, tendons, ligaments, and cartilage in the legs, neck, and lower back². Common symptoms include pain, fatigue, stiffness, and muscle weakness, which can interfere with work activities and the quality of life of individuals who experience it³.

In the world of dentistry, especially in dental professional students, the risk of MSDs is quite high. This is due to an awkward and prolonged working posture when performing dental treatment procedures. In addition, students often perform repetitive movements without adequate rest, as well

as a lack of ergonomic adjustments in the workplace⁴. High workload and academic stress can also lead to mental stress, which further increases the risk of musculoskeletal disorders⁵.

Some studies show that the prevalence of MSDs in the dental profession is very high, ranging from 64% to 93%⁶. A study in the United States reported that 75,1% of dental health workers experienced hand disorders, while a study in Saudi Arabia found that 68% of dental students experienced pain in the lower back, shoulders, and neck⁷. In Indonesia, research conducted on dentists and dental students found that there were five highest complaints of MSDs, namely waist 55%, right shoulder 49%, upper neck 48%, wrist 45% and lower neck 42%⁸.

Pathophysiologically, MSDs occur due to unergonomic posture, repetitive movements, lack of rest, and prolonged mental stress. This condition can impact muscles, ligaments, and cartilage, leading to pain and impaired mobility⁸. In the context of dental education, various studies have proven that students of the dental profession are prone to MSDs due to a lack of awareness of ergonomics in their clinical practice^{9–11}.

The results of a preliminary study at the Teaching Dental and Oral Hospital (RSGMP) of the Universitas Muhammadiyah Semarang (Unimus) showed that three out of five dental professional students experienced complaints of pain in the neck, back, and hands due to repetitive clinical activities. However, there is still little research that specifically addresses the factors in the dental education environment that contribute to the prevalence of MSDs in professional students, especially at RSGMP Unimus.

With the vacancy of the study, this study aims to describe complaints of MSDs in dental professional students at RSGMP Unimus. In addition to ergonomic factors, this study also suspects that there are other factors that can contribute to the occurrence of MSDs, such as suboptimal rest patterns, academic stress, and exercise habits and physical activity outside the clinical setting. It is hoped that the results of this study can be the basis for the development of prevention and intervention strategies to reduce the risk of MSDs in dental professional students.

II. METHOD

This type of research is observational with a *cross-sectional* design which will be carried out in Januari-February 2025. The total population of 127 subjects who are young dental professional students of the Semarang Teaching Dental and Oral Hospital. Sampling in this study used a *simple random sampling technique* calculated with the slovin formula and the results of 56 subjects were obtained. The independent variables in this study were age, gender, Force level, BMI (body mass index), length of exercise, exercise habits, length of work and level of knowledge related to dental ergonomics. The bound variable of *musculoskeletal disorders* complaints was measured using the Nordic Body Maps (NBM) questionnaire to assess attitudes towards musculoskeletal disorders (MSDs) complaints felt in dental professional students at RSGM Universitas Muhammadiyah Semarang.

This research has received ethical approval from the health research ethics commission, Dental and Oral Hospital, Universitas Muhammadiyah Semarang No. 004/RSGM.KEPK/PE/2025. The research began with the signing of *informed consent*, after which a questionnaire interview was conducted. Univariate data analysis to determine the frequency distribution of each variable and presented in the form of a frequency table with a mean value \pm standard deviation or as a median (minimum-maximum) with software for data analysis was carried out using IBM SPSS Statistics 21.

III. RESULTS AND DISCUSSION

Based on the results in table 1, the frequency distribution at the age of mostly 23 and 24 years old (30,4%), gender mostly (75,0%), the highest force level in Batch XI (44,6%), BMI (Body Mass Index) as much as (69,6%) had ideal results, exercise was mostly less than 1 hour (62,5%). Most of the subjects did not smoke (89,3%), the duration of work was mostly more than 12 months (80,4%). The level of knowledge related to ergonomic dental is mostly good (96,4%) and most of them have complaints of musculoskeletal disorders in the moderate category (82,1%),

In Table 2, the data shows that the 26-year-old age group has the lowest complaints of MSDs with only 4,3% in the medium category and 0% in the high and very high category. Women are more susceptible to experiencing complaints of high levels of MSDs (77,8%) than men (22,2%). Level XIII students have the highest proportion in the high category (44,4%) and are the only ones who experience very high complaints. Individuals with obesity (77,8%) as well as those who rarely exercise for less than 1 hour have a higher risk of experiencing high and very high complaints. Working time of more than 12 months was also associated with higher complaints (77,8%). In addition, individuals with low ergonomics knowledge had the highest proportion in the high category (100%) and were the only group to experience very high complaints, suggesting that a lack of understanding of ergonomics contributed to an increase in MSD complaints.

Based on table 3, it shows that the frequency distribution based on the level of MSDs complaints is the majority of non-

painful complaints are found in the left forearm (96,4%), followed by the left elbow and left hand (92,9%), as well as the left elbow and the sole of the left foot (91,9%). Complaints of mild pain were most common in the back (58,9%), waist (51,8%), and right shoulder (42,9%). The majority of pain complaints occurred in the back (21,4%), followed by the right shoulder (16,1%) and waist (12,5%). Meanwhile, complaints of extreme pain were most experienced in the back (5,4%), followed by the waist, lower waist, and buttocks (3,6%), as well as several other parts of the body with a smaller percentage (1,8%).

Individual factors have an important role in the incidence of musculoskeletal disorders in dental professional students at RSGM Universitas Muhammadiyah Semarang. Gender is one of the factors that contribute to the rate of musculoskeletal disorders than men, which can be attributed to physiological differences, such as lower muscle strength, more flexible joint structure, and hormonal changes that affect pain perception and muscle endurance¹³. Previous research has shown that women report musculoskeletal pain more often than men, especially in professions that require static postures and repetitive movements over long periods of time, such as dentistry¹⁴.

TABLE 1. Frequency distribution

Variable	Category	f	(%)
Age (years)	22	7	12,5
	23	17	30,4
	24	17	30,4
	25	13	23,2
	26	2	3,6
	Gender	Man	14
Woman		42	75,0
Force Level	IX	17	30,4
	X	2	3,6
	XI	25	44,6
	XII	7	12,5
	XIII	5	8,9
BMI (body mass index)	Low	4	7,1
	Ideal	39	69,6
	Excess Weight	9	16,1
	Obesity	4	7,1
Long Exercise (hours)	≤ 1	35	62,5
	>1	21	37,5
Smoking Habits	Yes	6	10,7
	No	50	89,3
Length of Work (month)	≤ 12	11	19,6
	>12	45	80,4
Dental Ergonomics Knowledge	Moderate	2	3,6
	Good	54	96,4
Complaints of Musculoskeletal Disorders	Moderate	46	82,1
	High	9	16,1
	Very High	1	1,8

TABLE 2, MSDs Complaints Based on Subject Characteristics

Variable	MSDs Complaints					
	Moderate		High		Very High	
	f	%	f	%	f	%
Age (years)						
22	11	23,9	3	33,3	1	100
23	15	32,6	3	33,3	0	0
24	10	21,7	1	11,1	0	0
25	8	17,4	2	22,2	0	0
26	2	4,3	0	0	0	0
Gender						
Man	14	30,4	2	22,2	0	0
Women	32	69,6	7	77,8	1	100
Force Level						
IX	9	19,6	2	22,2	0	0
X	2	4,3	0	0,0	0	0
XI	16	34,8	2	22,2	0	0
XII	1	2,2	1	11,1	0	0
XIII	18	39,1	4	44,4	1	1
BMI (body mass index)						
Low	4	8,7	0	0	0	0
Ideal	31	67,4	7	77,8	1	100
Excess Weight	8	17,4	1	11,1	0	0
Obesity	3	6,5	1	11,1	0	0
Long Exercise (hours)						
≤ 1	29	63,0	5	55,6	1	100
>1	17	37,0	4	44,4	0	0
Smoking Habits						
Yes	6	13,0	0	0	0	0
No	40	87,0	9	100	1	100
Length of Work (month)						
≤ 12	9	19,6	2	22,2	0	0
>12	37	80,4	7	77,8	1	100
Dental Ergonomics Knowledge						
Moderate	44	95,7	9	100	1	100
Good	2	4,3	0	0	0	0

No	Complaints	Complaint Rate							
		Doesn't Hurt		A Bit Painful		Painful		Very Painful	
		f	%	f	%	f	%	f	%
1	Pain in the upper neck	19	33,9	28	50	8	14,3	1	1,8
2	Pain in the lower neck	28	50	22	39,8	5	8,9	1	1,8
3	Pain in the left shoulder	36	64,3	14	25	5	8,9	1	1,8
4	Pain in the right shoulder	22	39,3	24	42,9	9	16,1	1	1,8
5	Pain in the back	8	14,3	33	58,9	12	21,4	3	5,4
6	Pain in the right upper arm	34	60,7	17	30,4	4	7,1	1	1,8
7	Pain in the waist	18	32,1	29	51,8	7	12,5	2	3,6
8	Pain below the waist	37	66,1	11	19,6	6	10,7	2	3,6
9	Pain in the buttocks	44	78,6	10	17,9	0	0	2	3,6
10	Pain in the left elbow	52	92,9	3	5,4	1	1,8	0	0
11	Pain in the right elbow	51	91,1	4	7,1	1	1,8	0	0
12	Pain in the left forearm	54	96,4	1	1,8	1	1,8	0	0
13	Pain in the right forearm	42	75	11	19,6	3	5,4	0	0
14	Pain in the left wrist	48	85,7	6	10,7	1	1,8	1	1,8
15	Pain in the right wrist	36	64,3	15	26,8	4	7,1	1	1,8
16	Pain in the left hand	52	92,9	3	5,4	1	1,8	0	0
17	Pain in the right hand	43	76,8	9	16,1	3	5,4	1	1,8
18	Pain in the left thigh	50	89,3	5	8,9	1	1,8	0	0
19	Pain in the right thigh	47	83,9	7	12,5	2	3,6	0	0
20	Pain in the left knee	50	89,3	4	7,1	2	3,6	0	0
21	Pain in the right knee	49	87,5	5	8,9	2	3,6	0	0
22	Pain in the left calf	46	82,1	9	16,1	1	1,8	0	0
23	Pain in the right calf	46	82,1	10	17,9	0	0	0	0
24	Pain in the left ankle	46	82,1	9	16,1	1	1,8	0	0
25	Pain in the right ankle	46	82,1	9	16,1	1	1,8	0	0
26	Pain in the sole of the left foot	51	91,1	3	5,4	2	3,6	0	0
27	Pain in the sole of the right foot	50	89,3	3	5,4	3	5,4	0	0

The age of the respondents in this study ranged from 22–26 years, which was a period of high clinical training intensity, Dental students in this age range face increased workload and exposure to ergonomic risks due to less than

ideal working positions, repetitive movements, and long work durations, Although young age is generally associated with better physical endurance, prolonged occupational exposure can increase the risk of musculoskeletal injury if not balanced with the application of proper ergonomic principles¹⁵, Some studies state that the longer a person works with an unergonomic posture, the higher the risk of developing musculoskeletal disorders due to accumulated muscle fatigue and mechanical stress^{16,17},

In addition, body mass index (BMI) is also a factor that can contribute to the incidence of musculoskeletal disorders, Individuals with higher BMI have a greater tendency to experience complaints due to increased mechanical load on the musculoskeletal system¹⁸, Excess weight can increase the pressure on the joints, especially when working in a static position for long periods of time, In contrast, individuals with low BMI may have weaker muscle strength, making them more susceptible to muscle fatigue which can increase the risk of musculoskeletal pain¹⁹,

A static working position for long periods of time, especially when performing actions such as dental examinations, cleanings, and restorations, causes excessive stress on certain muscle groups²⁰, Unergonomic sitting positions, the use of inappropriate tools, as well as the lack of facilities that support good working posture can exacerbate the risk of musculoskeletal²¹, In dental practice, the forward bending position and frequent rotation of the neck can cause tension in the neck, shoulders, and lower back muscles, which, if continued, can lead to long-term²²

Complaints of moderate Musculoskeletal Disorders with a working period of >12 months were 37 people (80,4%), This is due to the length of the working period which also plays a role in the occurrence of MSDs and the degree of severity felt by dental students, Musculoskeletal Disorders take a long time to develop, the longer a person's working life, the higher the risk of a person developing MSDs complaints²³,

The duration of work without sufficient breaks is also a factor that increases the risk of musculoskeletal disorders, Students of the dental profession often have to work for long periods of time without adequate rest, leading to the accumulation of muscle fatigue²⁴, Some studies confirm that regular work breaks can help reduce muscle fatigue and lower the risk of work-related injuries^{8,25}, Therefore, the application of preventive strategies such as regular muscle stretching, ergonomic posture settings, and regular interval breaks are highly recommended to reduce the physical load on the body,

High workloads, academic demands, as well as stress in the work environment can increase muscle tension contributing to an increased risk of musculoskeletal pain²⁶, Stress can lead to an unconscious increase in muscle tension, especially in the neck, shoulders, and back areas, which in the long run can worsen musculoskeletal conditions, In addition, a lack of physical activity or insufficient duration of exercise can also exacerbate this problem, as muscles that are rarely used or strengthened are more prone to fatigue and injury, Regular physical exercise, especially those that focus on stretching and strengthening muscles, can help reduce the risk

of musculoskeletal pain as well as increase muscle resistance to work stress²⁷,

To reduce the risk of musculoskeletal disorders in dental students, comprehensive preventive efforts are needed, Education about ergonomics must be improved so that students better understand the importance of correct posture and how to reduce muscle tension during work, In addition, the provision of ergonomic work facilities, such as chairs and tools that can be adjusted to the posture, needs to be considered to reduce pressure on the musculoskeletal system, The application of simple physical exercises before and after work can also help improve muscle flexibility and reduce the risk of work-related injuries, With greater awareness of risk factors for musculoskeletal disorders and the implementation of appropriate prevention strategies, it is hoped that dental students can work more comfortably and productively without experiencing negative impacts on their musculoskeletal health,

IV. CONCLUSION

Based on the results of the analysis, it can be concluded that the majority of dental professional students at RSGMP Universitas Muhammadiyah Semarang experience moderate Musculoskeletal Disorders (MSDs) complaints, In terms of individual characteristics, most of the respondents were female, aged 23–24 years, and had an ideal Body Mass Index (BMI),

Regarding lifestyle, the majority of respondents have a duration of exercise ≤ 1 hour per week and do not have a smoking habit, Based on employment factors, MSDs complaints are most commonly found in students with a working period of >12 months, Meanwhile, the majority of the level of knowledge about dental ergonomics is in the good category,

To reduce the risk of musculoskeletal disorders, a comprehensive prevention strategy is needed, including education on ergonomics, the use of work tools that support good posture, the application of periodic rest, and physical exercise that can help reduce muscle tension, By applying the principles of ergonomics and proper preventive measures, it is hoped that dental students can work more comfortably and productively without experiencing a negative impact on their musculoskeletal health,

REFERENCES

- 1, Windi Windi Rs, Penerapan Postur Tubuh Yang Ergonomis Oleh Mahasiswa Tahap Profesi Fakultas Kedokteran Gigi Universitas Hasanuddin Selama Prosedur Perawatan, *Former J Dentofasial*, Published Online 2021,
- 2, Gregg C, Visconti Vv, Albanese M, Et Al, Work-Related Musculoskeletal Disorders: A Systematic Review And Meta-Analysis, *J Clin Med*, 2024;13(13), Doi:10.3390/Jcm13133964
- 3, Kapitán M, Pilbauerová N, Vavříčková L, Šustová Z, Machač S, Prevalence Of Musculoskeletal Disorders Symptoms Among Czech Dental Students, Part 1: A Questionnaire Survey, *Acta Medica (Hradec Kral Czech Republic)*, 2018;61(4):131-136, Doi:10.14712/18059694.2018.131
- 4, Davoudi-Kiakalayah A, Mohammadi R, Pourfathollah Aa, Siery Z, Davoudi-Kiakalayah S, Alloimmunization In Thalassemia Patients: New Insight For Healthcare, *Int J Prev Med*, 2017;8:1-5, Doi:10.4103/Ijpv.M.Ijpv.M
- 5, Hagen K, Linde M, Heuch I, Stovner Lj, Zwart Ja, Increasing Prevalence Of Chronic Musculoskeletal Complaints, A Large 11-Year

- Follow-Up In The General Population (Hunt 2 And 3), *Pain Med*, 2011;12(11):1657-1666, Doi:10.1111/J.1526-4637.2011.01240.X
- 6, Hayes M, Smith D, Cockrell D, Prevalence And Correlates Of Musculoskeletal Disorders Among Australian Dental Hygiene Students, *Int J Dent Hyg*, 2009;7(3):176-181, Doi:10.1111/J.1601-5037.2009.00370.X
 - 7, Zafar H, Almosa N, Prevalence Of Work-Related Musculoskeletal Disorders Among Dental Students Of King Saud University, Riyadh, Kingdom Of Saudi Arabia, *J Contemp Dent Pract*, 2019;20(4):449-453,
 - 8, Ningrum V, Bakar A, Rifani, Hubungan Antara Kebiasaan Olahraga Dan Masa Kerja Dengan Keluhan Musculoskeletal Disorder Pada Dokter Gigi Dan Mahasiswa Kedokteran Gigi Di Sumatera Barat, *J Kedokteran Gigi Univ Baiturrahmah*, 2019;6(1):17-23,
 - 9, Solanki H, Sodani V, Sarvaiya B, Chauhan K, Shah R, Assessment Of Awareness, Attitude, Knowledge And Application Towards Dental Ergonomics And Musculoskeletal Disorder Among Dental Students And Professionals In Ahmedabad, *Int J Community Med Public Heal*, 2024;11(2):899-903. Doi:10.18203/2394-6040.Ijcmph20240284
 - 10, Hussain Ask, Devaraj Dk, Michael Mj, Murugesan M, Vishnudas P, Pattern Of Tooth Mortality In Patients Attending A Tertiary Dental Care Center: A Descriptive Study, *J Dent Res Rev*, 2022;9(2):143-147, Doi:10.4103/Jdr.Jdr
 - 11, Kumar M, Mishra G, Vaibhav R, Priyadarshini S, Simran, Turagam N, Assessment Of Knowledge About Ergonomics And Determining Musculoskeletal Disorders In Dentists: An Original Research, *J Pharm Bioallied Sci*, 2021;13(Suppl 1):S391-S394, Doi:10.4103/Jpbs.Jpbs_591_20
 - 12, Ogunlana Mo, Govender P, Oyewole Oo, Prevalence And Patterns Of Musculoskeletal Pain Among Undergraduate Students Of Occupational Therapy And Physiotherapy In A South African University, *Hong Kong Physiother J Off Publ Hong Kong Physiother Assoc Ltd = Wu Li Chih Liao*, 2021;41(1):35-43, Doi:10.1142/S1013702521500037
 - 13, Ramírez-Sepúlveda Ka, Gómez-Arias My, Agudelo-Suárez Aa, Ramírez-Ossa Dm, Musculoskeletal Disorders And Related Factors In The Colombian Orthodontists' Practice, *Int J Occup Saf Ergon*, 2022;28(1):672-681, Doi:10.1080/10803548.2020.1857975
 - 14, Ohlendorf D, Erbe C, Nowak J, Et Al, Constrained Posture In Dentistry - A Kinematic Analysis Of Dentists, *Bmc Musculoskelet Disord*, 2017;18(1):291, Doi:10.1186/S12891-017-1650-X
 - 15, Andersen Ll, Vinstrup J, Sundstrup E, Skovlund S V, Villadsen E, Thorsen S V, Combined Ergonomic Exposures And Development Of Musculoskeletal Pain In The General Working Population: A Prospective Cohort Study, *Scand J Work Environ Health*, 2021;47(4):287-295, Doi:10.5271/Sjweh.3954
 - 16, Soo Sy, Ang Ws, Chong Ch, Tew Im, Yahya Na, Occupational Ergonomics And Related Musculoskeletal Disorders Among Dentists: A Systematic Review, *Work*, 2023;74(2):469-476, Doi:10.3233/Wor-211094
 - 17, Nurhidayah I, Amalia R, Kamal A, Correlation Between Duration And Sitting Position With The Incidence Keywords : Sitting Duration ; Sitting Position ; Lower Back Pain, 2023;12(11):10-14,
 - 18, Afro Hs, Paskarini I, Hubungan Antara Imt Dan Kebiasaan Merokok Dengan Keluhan Musculoskeletal Disorders Pada Petani Padi Di Desa Doho, Kabupaten Madiun, Jawa Timur, *Prev J Kesehat Masy*, 2022;13(1):98-111, Doi:10.22487/Preventif.V13i1.249
 - 19, Prevalence And Determinants Of (Work - Related) Musculoskeletal Disorders Among Dentists - A Cross Sectional Evaluative Study, Published Online 2023, Doi:10.4103/Ijdr,Ijdr
 - 20, De Sio S, Traversini V, Rinaldo F, Et Al, Ergonomic Risk And Preventive Measures Of Musculoskeletal Disorders In The Dentistry Environment: An Umbrella Review, *Peerj*, 2018;6:E4154, Doi:10.7717/Peerj.4154
 - 21, Hulshof Ctj, Pega F, Neupane S, Et Al, The Effect Of Occupational Exposure To Ergonomic Risk Factors On Osteoarthritis Of Hip Or Knee And Selected Other Musculoskeletal Diseases : A Systematic Review And Meta-Analysis From The Who / Ilo Joint Estimates Of The Work-Related Burden Of Disease And Injury, *Environ Int*, 2021;150:106349, Doi:10.1016/J.Envint.2020.106349
 - 22, Gandolfi Mg, Zamparini F, Spinelli A, Prati C, Āsana For Neck, Shoulders, And Wrists To Prevent Musculoskeletal Disorders Among Dental Professionals: In-Office Yōga Protocol, *J Funct Morphol Kinesiol*, 2023;8(1), Doi:10.3390/Jfmk8010026
 - 23, Gopika Pm, Sasi St, Olickal Jj, Thankappan Kr, High Prevalence Of Work-Related Musculoskeletal Disorders Among Dentists: A Cross-Sectional Study From Kerala, India, *Cureus*, 2024;16(9):E70254, Doi:10.7759/Cureus.70254
 - 24, Kumari M, Bhati M, Sharma P, Exploring The Most Frequent Musculoskeletal Disorders Indental Students- A Questionnaire Based Survey, 2023;9(4):214-217,
 - 25, Leggat Pa, Smith Dr, Musculoskeletal Disorders Self-Reported By Dentists In Queensland, Australia, *Aust Dent J*, 2006;51(4):324-327, Doi:10.1111/J.1834-7819.2006.Tb00451.X
 - 26, Al-Huthaifi Bh, Al Moaleem Mm, Alwadai Gs, Et Al, High Prevalence Of Musculoskeletal Disorders Among Dental Professionals: A Study On Ergonomics And Workload In Yemen, *Med Sci Monit Int Med J Exp Clin Res*, 2023;29:E942294, Doi: 10.12659/Msm.942294
 - 27, Holzgreve F, Fraeulin L, Maurer-Grubinger C, Et Al, Effects Of Resistance Training As A Behavioural Preventive Measure On Musculoskeletal Complaints, Maximum Strength And Ergonomic Risk In Dentists And Dental Assistants, *Sensors (Basel)*, 2022;22(20), Doi:10.3390/S22208069