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ASSESMENT OF AWARENESS AND ATTITUDE OF DENTAL ERGONOMICS AMONG INTERNATIONAL STUDENTS

Master's Thesis

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Assessment of awareness and attitude of dental ergonomics among international students

Master's Thesis 2020

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Kaunas, 2020

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SUMMARY

Aim: To evaluate attitude and awareness of dental ergonomics among international dental students at LSMU.

Material and methods: 100 2nd-5th academic year international dental students were enrolled in this study. The self-administered consisted of 25 questions about sociodemographic characteristics, self-reported pain prevalence, duration spent with gadgets, hours of clinical practice, attitude and awareness towards ergonomics and spinal and lumbar back pain. The questionnaires were distributed through online. Participation was anonymous and voluntarily. Data were analyzed using SPSS 20.

Results: Participants were 52% female and 48% male. Overall 75% of dental students knew the correct ergonomic posture during clinical work. Additionally, a half (51.0%) of all participants experienced lumbar and cervical pain during day. Considering the complaints of spinal pain, the most commonly dental students (37.4%) reported about appeared spinal back pain after 1 hour of clinical work. Furthermore, 72.4% of dental students believed that spinal pain had negative impact on the quality of life. In addition, more senior year dental students (85.7%) believed that lumbar and cervical back pain negatively affected the quality of life.

Conclusions: Majority of international dental students were aware toward dental ergonomics. Although senior students spent more time during clinical practice than younger ones, majority of dental students among them reported about experienced lumbar pain. Thus more emphasis of dental ergonomics is needed among dental undergraduates.

Keywords: Ergonomics, awareness, pain, attitude, musculoskeletal disorders, dental students,

INTRODUCTION

Physical health among health care workers is equally important in relation to their general health. Spinal back pain is one of the leading reasons for everyday discomfort that has an impact both physical and mental state. Moreover, the pain involving spinal back pain is one of the most leading occupational health problems in the European Union [1].

The dentistry profession requires constant change in position in order to gain access in patient's oral cavity. Thus, a dentist, dental assistants or oral hygienists may have to bend over and extending their torso in different angles and simultaneously maintain composure with raised arms for ability to achieve delicate movements in limited work space of patient's oral cavity [2]. Maintaining healthy physical condition without experiencing any pain during clinical work has been and continues to be a challenge among the dental profession and dental undergraduates [3]. Consequently, dentists are suffering lower back and neck pain more than any other occupational profession due to long hours spent of static work.

Overall, dentist could spend up to 60,000 hours in their career operating in stressed and uncomfortable ergonomic postures that can cause the physical health problem such as spinal back pain [4]. Operational posture is one of the most common dental risk factor of musculoskeletal pain [5]. The harmful postures endure static pressure which in turn are cause fatigue in muscles of the back, neck and shoulders [5].
The main principles of ergonomics or a proper posture include keeping upright posture, sitting with the thighs parallel to the floor at a 90° angle with the legs/feet supported by the floor and avoiding rounding the back into "C" shape, alternatives between sitting and standing to prevent static workloads, using adjustable chair with support for lumbar, cervical and arm support and maintaining a distance of 30 to 40 cm between the operator's eyes and the mannequin's mouth [5].

The dental industry develops the modern technologies suitable for dentists [5].
New technology such as innovative ergonomic stools are introduced that makes daily routine of a dental operator and dental assistant more comfortable allowing for more suitable working posture. Furthermore, magnification loupes reduce muscle activity in neck and shoulder region during clinical practice [6].
Dental undergraduates are the future of dentistry, therefore they should have a good knowledge and awareness of dental ergonomics. Furthermore, the teaching institution is responsible for deeper educating as well. The dental students must take this at utter most importance [3] Finally,

continuous education and proper knowledge are able to correct the detrimental ergonomic postural behaviours and to prevent chronic pain that can appear early in dental careers [4].

Hypothesis: In this study we expect that physical back discomfort is common among international dental students due to probably incorrect ergonomics during clinical practice. The self-reported complains should increase with experience of clinical practicing.

The aim of research: To evaluate attitude and awareness of dental ergonomics among international dental students at LSMU.

Objectives:

1. To assess knowledge of dental ergonomics, to evaluate duration spent with gadgets and clinical practice spent during studies among international dental students at LSMU.

2. To compare dental students' knowledge of dental ergonomics, duration of clinical practice during studies and experience of spinal back pain between different academic year of studies.

3. To evaluate then main factors leading to self-reported back pain among international dental students at LSMU.

REVIEW OF LITERATURE

Significant issues of musculoskeletal disorders in the dentistry

Numerous studies were carried out to assess the prevalence of work-related spinal back injuries among dental profession's and dental undergraduates**.** Worldwide the prevalence in lower back pain was above 50% of all participants that experienced musculoskeletal discomfort. [3, 7, 8, 9]. Furthermore, 70-90% of people experience repeated episodes of chronic lower back pain. [4]
In Lithuanian 91% of dentists reported about back pain [7].

Effect of Ergonomics in dentistry

Study performed in Spain confirmed that usage of different ergonomic support (magnification loupes, ergonomic chair) during dental procedures reduces muscle activity of neck and shoulder. Meanwhile, muscle activity of upper extremity (trapezius and deltoid muscles) was measured by an electromagnetic recorder during dental procedures. Combining of two ergonomic supports showed highest reduction of muscle activit [6].
Furthermore, dentists tend to retire due to mostly musculoskeletal disorders, cardiovascular disease, neurotic symptoms, tumours and diseases of nervous system [10].

Prevention care of dental ergonomics

In order to prevent the further health problems, it is recommended to have the short breaks between patients, relax the wrists and arms, and perform few movements different from those used during work. During breaks muscle relax of lower back can be achieved with exercises which will improve muscular strength, flexibility, increase stamina and tendon strength and decrease the risk of overburdening. Additionally, the current recommendation can increase longevity of dental professional career, if dentists will correct the ergonomic problem in the operatory, will resolve with major trigger points before any strengthening exercise will be attempted, will have consultations with therapist's specialists for musculoskeletal disorders, will strengthen muscles, neck, shoulder and back [4].

MATERIAL AND METHODS

A cross-sectional study was conducted to evaluate awareness and attitude of dental ergonomics among international students at the Lithuanian University of Health Science (LSMU) during 2019/ 2020 study year Kaunas, Lithuania.

A self-administered structured anonymous questionnaire distributed through online using Google Forms during the spring of 2020.

The participation of this study was voluntary and anonymous; thus, return of the completed questionnaire was considered as acceptance to participate.

Ethical approval for this study was obtained from the Bioethics Center of LSMU, Kaunas Nr.BEC-OF112.

Subjects

The subjects were international dental students of 2nd year until 5thacademic year of the Odontology faculty at LSMU. 140 international dental students from 2nd to 5th academic year study in the Odontology program of LSMU during 2019/2020 study year. All international dental students (2nd – 5th year academic year) were invited to take part in the survey. A total of 100 international dental students participated in this study. The response rate of study was 71.4%.

The questionnaire

An anonymous self-administered questionnaire was developed by investigator Allan Partovi and scientific supervisor, it included 25 questions in English and divided into 3 sections.

The first part of the questionnaire included questions related to background characteristics (gender, academic year and dominant hand).

Second part of the questionnaire included awareness of correct idea of dental ergonomic posture; *Sitting with the thighs parallel to the floor at a 90° angle with the legs/feet supported by the floor and avoiding rounding the back into "C" shape maintaining a distance of 30 to 40 cm between the operator's eyes and the mannequin's mouth" or incorrect regarding ergonomic posture; "Adjusting the position for yourself until you feel comfortable in various angle between floor and legs/feet"*

Preference of choice in clinical work; "sitting"," standing" or "both (combination)".

Additionally daily life behaviors that could have ergonomic effect on each individual; such as clinical practice hours per week (1-2hours, 3-5hours, 5-6hours, 6+ hours per week) the usage of electronical devices per day (1-2hours, 3-4hours, 5-7hours, 7+hours per day) physical workout per week (1-2 times, 3-4times, 5-7times per week) amount of sleep per day(3-6hours,7-8hours, more than >8 hours).

Third part of the questionnaire included questions regarding pre-existing pain, (yes or no) when pain usually appears during the day(during morning, afternoon, evening, night, only during clinical practice, do not experience any pain) location of pain(cervical, lumbar, or both) intensity of pain(from scale 0-no pain to 10-unbearable), attitude regarding correlation of clinical work with pain and negative impact in life (yes, no).

Data analysis

Data were processed using MS Excel 2010 and analyzed using IBM SPSS Statistics version 20. The descriptive analysis included the calculation of the prevalence: categorical data were presented as percentages (%) and frequencies (n). Comparisons were done using the Chi-Square Test. The statistical significance level was set at 95% ($p<0.05$).

RESULTS

Overall participants were 52.0% female and 48.0% male. The biggest group of undergraduates was 4th academic year dental students (30.0%), while the smallest groups (19.0%) was 2nd academic year dental students, respectively. Majority of participants were dominant right-handed (81%).

Table 1. Characteristics of the participants (N=100) by gender, academic year and dominant hand.

Variables	Total N (%)
Gender	
Male	48 (48.0)
Female	52 (52.0)
Total	100 (100.0)
Academic year	
2nd year	19 (19.0)
3rd year	22 (22.0)
4th year	30 (30.0)
5th year	29 (29.0)
Total	100 (100.0)
Dominant hand	
Left-handed	19 (19.0)
Right-handed	81(81.0)
Total	100(100.0)

Chi-square test; P > 0.05. Comparing results by students' academic year.

Overall, 75% of dental students knew that a correct ergonomic posture during clinical work. More 2nd-3rd year academic year dental students reported knowing about ergonomic posture than senior ones (80.5% vs. 71.2%), but it did not differ statistically (p=0.291). Results showed that a half (51%) of participants preferred sitting position during clinical practice. Subsequently, significantly younger students (82.9%) had clinical practice 3-5 hours/week, while more senior dental students (40.7%)

reported having clinical practice at least 6 hours/week ($p<0.001$). Results revealed that more 4^{th}-5^{th} year dental students treated a patient for 1-2 hours or more than younger ones that spend average 1-2hours per patient (66.1% vs. 61.0%) ($p=0.029$).

Table 2. Prevalence in clinical practice behaviors Duration of practical practicing and attitude toward ergonomics among international dental students (N=100).

Variables	Academic year N (%)		Total N (%)	P- Value
	2^{nd} - 3^{rd} Year	4^{th} - 5^{th} Year		
Knowing of correct ergonomic posture during practice				
No	8(19.5)	17(28.8)	25(25.0)	0.291
Yes	33(80.5)	42(71.2)	75(75.0)	
Total N(%)	41(100.0)	59(100.0)	100(100.0)	
Preferred position during clinical work				
Sitting	24(58.5)	27(45.8)	51(51.0)	0.589
Standing	0(0.0)	3(5.1)	3(3.0)	
Both	17(41.5)	29(49.1)	46(46.0)	
Total N (%)	41(100.0)	59(100.0)	100 (100.0)	
Clinical practicing (Hours/week)				
1-2hours	4(9.8)	0(0.0)	4(4.0)	<0.001
3-5hours	34(82.9)	14(23.7)	48(48.0)	
5-6hours	3(7.3)	21(35.6)	24(24.0)	
6+hours	0(0.0)	24(40.7)	24(24.0)	
Total N(%)	41(100.0)	59(100.0)	100(100.0)	
Average time spent per patient (Hours/patient)				
<1hour	15(36.6)	11(18.6)	26(26.0)	0.029
1-2hours	25(61.0)	39(66.1)	64(64.0)	
>2hours	1(2.4)	9(15.3)	10(10.0)	
Total N(%)	41(100.0)	59(100.0)	100(100.0)	

Chi-square test; Comparing results by students' academic year

Table 3 presented results of various gadget usage and general training. Overall, 9.0% of participants used cell phones for 1-2 hour/day and 47.0% of dental students used mobile phone at least 5 hours/day (p=0.195). Furthermore, 43.0% of dental students work with personal computer 3-4 hours/day (p=0.180). Overall, a minority (27.0%) of dental students reported not training at all, while most of them (35.0%) trained 1-2 times a week (p=0.996) (Table 3).

Table 3 Activities of daily living habits among participants (N=100).

Variables	Academic year N (%)		Total N (%)	P- Value
	2nd - 3rd Year	4th - 5th Year		
Usage of mobile phone (hours/day)				
1-2hours	2 (4.9)	7(11.9)	9(9.0)	0.195
3-5hours	15 (28.8)	29(49.2)	44(44.0)	
5+hours	24 (65.9)	23 (39.0)	47 (47.0)	
Total N (%)	41(100.0)	59(100.0)	100 (100.0)	
Usage of P/C (hours/day)				
1-2hours	12(29.3)	20(33.9)	32(32.0)	0.180
3-4hours	15(36.6)	28(47.5)	43(43.0)	
>5hours	12(29.3)	11(18.6)	23(23.0)	
None	2(4.9)	0(0.0)	2(2.0)	
Total	41(100.0)	59(100.0)	100(100.0)	
Doing physical work out (Times/week)				
No training	11(26.8)	16(27.1)	27(27.0)	0.996
1-2 times / week	14(34.1)	21(35.6)	35(35.0)	
3-4 times / week	12(29.3)	16(27.1)	28(28.0)	
5-7 times / week	4(9.8)	6(10.2)	10(10.0)	
Total N (%)	41(100.0)	59(100.)	100 (100.0)	

Chi-square test; Comparing results by students' academic year

Overall, a half (51.0%) of all participants experienced pain in spine during day. Considering the complaints of pain, the most commonly dental students (37.4%) reported about appeared pain after 1 hour of clinical work. Subsequently, significantly more 2nd-3rd academic year dental students (47.2%) felt the pain during practice of preclinical studies, while senior students (61.4%) reported about pain during practice of clinical studies (p<0.001). Furthermore, 72.4% of dental students

believed that spinal pain had negative impact on the quality of life. In addition, more senior year dental students (85.7%) believed that pain negatively affected the quality of life than younger ones (55.3%) (p=0.002) (Table 4).

Table 4. Participants' reports of experienced pain during clinical practice and its impact on their life (N=100).

Variables	Academic year N (%)		Total N (%)	P- Value
	2nd - 3rd Year	4th - 5th Year		
Experience pain in any portion of spine during day				
Yes	25(61.0)	26(44.1)	51(51.0)	0.238
No	15(36.6)	30(50.8)	45(45.0)	
Other region	1(2.4)	3(5.1)	4(4.0)	
Total N (%)	41(100.0)	59(100.0)	100 (100.0)	
The presence of pain during clinical practice				
At beginning of dental procedure	3(7.3)	1(1.7)	4(4.0)	0.346
After 30 min	12(29.3)	12(20.7)	24(24.2)	
After 1 hour	14(34.1)	23(39.7)	37(37.4)	
No Pain	12(29.3)	22(37.9)	34(34.3)	
Total	41(100.0)	58(100.0)	99(100.0)	
The history of cervical/lumbar pain				
Prior studies in the University	10(27.8)	11(25.0)	21(26.3)	0.001
During practice of preclinical studies	17(47.2)	6(13.6)	23(28.8)	
During practice of clinical studies	9(25.0)	27(61.4)	36(45.0)	
Total N (%)	36(100.0)	44(100.0)	80 (100,0)	
Belief that a spinal pain has a negative impact on quality of life				
Yes	21(55.3)	42(85.7)	63(72.4)	0.002
No	17(44.7)	7(14.3)	24(27.6)	
Total N (%)	38(100.0)	49(100.0)	87 (100.0)	

Chi-square test; Comparing results by students' academic year.

Overall, 42.2% of dental students reported about pain presence only during clinical practice. Moreover, significantly more dental students with previous history of pain (33.3%) reported about pain on evening than dental students without any presence of pain before studies (19.2%)

(p=0.001). Furthermore, a majority (77.8%) did not need to take pain killers because of lumbar pain. Meanwhile, more dental students reporting about previous history of pain used pain killers than participants without any presence of lumbar pain (25.0% vs. 20.9%) (p=0.003). Subsequently, significantly fewer dental students with previous history of pain reported about experienced pain during clinical practice than participants without any presence of pain (33.3% vs. 50.0%) (p=0.007). Finally, 31.3% of dental students reported about nagging type of pain. In addition, significantly more dental students (30.0%) with previous history of pain reported about dull pain than undergraduates without any presence of pain (20.3%) (p<0.001) (Table 5).

Table. 5 Participants' reports about presence and type of pain by history of pain.

Variables	Pre-existing pain		Total N (%)	P- Value
	Yes	No		
Beginning of the pain (Missing N=1)				
Morning	3(14.3)	2(2.6)	5(5.1)	0.001
Afternoon	1(4.8)	2(2.6)	3(3.0)	
Evening	7(33.3)	15(19.2)	22(22.2)	
Night	3(14.3)	2(2.6)	5(5.1)	
Only during clinical practice	6(28.6)	36(46.2)	42(42.4)	
No experience of any pain	1(4.8)	21(26.9)	22(22.2	
Total N(%)	21(100.0)	78(100.0)	99(100.0)	
Need of any medication to relieve the pain from it (Missing N=1)				
Yes	2(25.0)	19(20.9)	21(21.2)	0.003
No	5(62.5)	72(71.1)	77(77.8)	
Other pain	1(12.5)	0(0.0)	1(1.0)	
Total N (%)	8(100.0)	91(100.)	99(100.0)	
The history of cervical/lumbar pain (Missing N=21)				
Before start of University	11(52.4)	9(15.5)	20(25.3)	0.007
During practice of preclinical studies	3(14.3)	20(34.5)	23(29.1)	
During practice of clinical studies	7(33.3)	29(50.0)	36(45.6)	
Total N (%)	21(100.0)	58(100.0)	79 (100.0)	
The intensity of the spinal pain (Missing N=20)				
Aching	5(25.0)	17(28.8)	23(28.8)	<0.001
Nagging	5(25.0)	20(33.9)	25(31.3)	
Sharp	2(10.0)	4(6.8)	6(7.5)	

Intense	2(10.0)	3(5.1)	5(6.3)	
Dull	6(30.0)	12(20.3)	18(22.5)	
Throbbing	0(0.0)	1(1.7)	1(1.3)	
No Pain	1(5.0)	2(3.4)	3(3.8	
Total N (%)	20(100.0)	59(100.0)	80(100.0)	

Chi-square test; Comparing results by existence of pain.

DISCUSSION

This study revealed level of knowledge among international dental students regarding dental ergonomic posture, it revealed that majority are aware of correct ergonomic posture, although during this study we also found out that a half of all international dental students participating had experienced lumbar pain during day, and results revealed that when the pain appeared more than half of all the participants reported only during clinical practice.

At Lithuanian University of Health Science, the dental program is divided into preclinical and clinical part. The preclinical part is made up of basic biomedical studies and lasts for 2 years, additionally clinical part of studies consists of 3 years specializing in the dental profession. 2nd year students are introduced to phantom-head laboratory, before starting operating a teacher shortly introduces and educates the dental students concerning position and posture. We can see that results shows that 2nd-3rd year students are more aware towards the correct dental ergonomic posture; this is probably due to more recent knowledge.

When we investigated the dental students with pre-existing pain almost one third reported that their pain is related with clinical practice, all leads back to clinical practice that relates health care workers with spinal back pain one of the most common concern.

Additionally, there is an increase of international dental students enrolling at LSMU each academic year, therefor an approach of identifying the importance of dental ergonomics must be comprehended in order to build healthy and sustainable dental careers early without physical chronic pain. [11]

Worldwide, health care workers within the dental profession are struggling with health issues related to static working posture, many researchers have put a lot of attention to it, a study made by Rundcrantz et al [12] presented that 95% of dentists worked in a sitting posture. In our study we found out that more than half of all the participants preferred sitting position during their clinical work.

However, various studies also revealed that dentists that combination between sitting and standing reported less frequent back pain. [8, 13, 14].

The curriculum of all international dental programme includes dental ergonomics, but even so with the knowledge various studies revealed that major issues is still among dentist worldwide that report physical discomfort. [15-17].

To conclude with reference of dental students partaking in this study despite awareness of correct ergonomic posture, spinal back pain related to clinical work are noted in more than half of the total international dental students participating. Furthermore, there is need for an improvement, that institute which provide education should partake a major role, keeping up-to-date with latest scientific studies concerning this topic that can prevent and provide adequate training and improve the general health for the dental professions [18].

Limitation of study

The data of this study was collected with self-administered questionnaire through online form via google forms, there might have been unintentional mistakes due to lack of experience. The self-administered questionnaire could not have been handed out throughout the students due to the current pandemic. The study included only international dental students that are taught in English, therefor the possibility of larger study involving all dental students at LSMU were not conceivable.

CONFLICT OF INTERESTS

The author has not encountered any conflict of interests during this research.

CONCLUSIONS

1. Two-thirds of all international students are aware of dental ergonomics, however 2nd-3rd year students showed more knowledge regarding correct posture of dental ergonomics. The students at LSMU participating in this study showed that almost half of all international students use their mobile phone at least 5 hours per day. Furthermore, majority of all international students did physical workout for at least 1-2times per week.
2. 4th-5th year students spend at least 5-6h or more per week in the clinical practice, whilst younger students spend in average 3-5 hours per week during their practice, additionally more than half of all international dental students experienced pain at any time during the day.
3. Main leading factors leading to back pain among all the participants revealed that majority reported that back pain started appearing due to clinical and preclinical studies and that the pain itself presented from half an hour until 1 hour of clinical practice duration.

ENSURING OF CONFIDENTIALITY

Confidentiality of responses will be maintained by using an anonymous questionnaire. The name, surname and address will not be included in the questionnaire

PRACTICAL RECOMMENDATIONS

Recommendations would be common sense putting the physical health in main focus, early on preventive useful methods for increase in comfort for dental profession in their daily life, this can be achievable by educating in matter of dental ergonomics by imposing physical demonstration during start of a dental practice. I believe this is possible to achieve by each by repetition each year and work extensively towards adjustments and improvement in work place concerning ergonomics.

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ANNEXES

Annex 1: Bioethical approval

LIETUVOS SVEIKATOS MOKSLŲ UNIVERSITETAS

BIOETIKOS CENTRAS

Kodas 302536989, Tilžės g. 18, LT- 47181, Kaunas,tel.: (8 37) 327233, www.lsmuni.lt., el.p.: bioetika@lsmuni.lt

Medicinos akademijos (MA) 2020-03-27 Nr. BEC-OF-112
Vientisųjų studijų programa – Odontologija
V k. studentui Allan Partovi
Darbo vadovė asist. Sandra Petrauskienė
LSMUL KK Burnos priežiūros ir vaikų
odontologijos klinika

DĖL PRITARIMO TYRIMUI

LSMU Bioetikos centras, įvertinęs Allan Partovi pateiktus dokumentus, studento tiriamajam darbui tema „Assessment of awareness and attitude of dental ergonomics among international dental students at LSMU“ pritaria*.

dr. Eimantas Peičius

* Pastaba: šis pritarimas neatleidžia tiriamąjį mokslinį darbą vykdančių asmenų nuo prievolės laikytis Bendrojo duomenų apsaugos reglamento nuostatų ir nuo atsakomybės gauti nacionalinio arba regioninio bioetikos komiteto leidimą, jei toks leidimas būtinas pagal LR Biomedicininių tyrimų etikos įstatyme numatytus reikalavimus.

Annex 2: The questionnaire is found in electronical online form:
https://forms.gle/tU7BkdVoLH3ZGeHe9