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Original Article

Self-reported frequency of temporomandibular disorders among undergraduate students at Taibah University

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الملخص

أهداف البحث: تهدف هذه الدراسة لتقييم انتشار وحدّة اضطرابات المفصل الصدغي الفكي بين طلاب المرحلة الجامعية. بالإضافة إلى ذلك، تمت مقارنة خطورة اضطرابات المفصل الصدغي الفكي من ناحية العلاقة بالجنس، والعمر، ومجال الدراسة.

طرق البحث: تمت دعوة ٤٣٩ طالبا جامعيا من كلا الجنسين (الفئة العمرية ٢٠-٢٧ عاما) يدرسون في كليات مختلفة بجامعة طيبة للاشتراك في هذه الدراسة. أُعطي كل طالب استبانة وتم شرح أهمية وغرض الدراسة. وجمعت البيانات بواسطة نموذج استطلاع فونيسكا؛ أداة تتضمن البيانات الديموغرافية للطلبة وعشرة أسئلة رئيسة. وصنفت حدة اضطرابات المفصل الصدغي الفكي على أنها غير موجودة، وبسيطة، ومتوسطة وشديدة. وحللت النتائج باستخدام الحزمة الإحصائية للعلوم الاجتماعية النسخة ٢٢. واُستخدم اختبار مربع كاي الإحصائي لمقارنة البيانات من مختلف المجموعات للدلالة الإحصائية.

النتائج: ٧٨ طالبا من مجموعة الدراسة لم يقوموا بإعادة الاستبانة، بينما تم استبعاد ١١ استبانة غير مكتملة. ذكر غالبية الطلبة (٤٦.٧%) أنه لا توجد اضطرابات في المفصل الصدغي الفكي أو موجودة بشكل بسيط (٤٢.٧%). وذكر ٨.٨% من الطلبة مستوى متوسط من اضطرابات المفصل الصدغي الفكي كما كانت الاضطرابات شديدة لدى ١.٧% فقط. لم تظهر أي دلالة إحصائية في شدة حدوث اضطرابات المفصل الصدغي الفكي من ناحية عمر الطالب ومجال الدراسة.

الاستنتاجات: اضطرابات المفصل الصدغي الفكي هي نسبيا أكثر انتشارا بين الطالبات، ولكن حدوثها لا يتأثر بالعمر ومجال الدراسة بين الطلبة.

الكلمات المفتاحية: طلاب المرحلة الجامعية؛ مجال دراسة الطلبة؛ استطلاع فونيسكا؛ اضطرابات المفصل الصدغي الفكي؛ جامعة طيبة

Abstract

Objectives: This study aimed to evaluate the prevalence and severity of temporomandibular joint (TMJ) disorders among undergraduate students. In addition, the severity of TMD was examined in terms of its relationship with gender, age and field of study.

Methods: A total of 439 undergraduate students of both genders (age range: 20–27 years) who were studying at various colleges at Taibah University were invited to participate in this study. Each student was provided with a questionnaire, and the significance and purpose of the study were explained. The data were collected using Fonseca's questionnaire, an instrument that assessed the demographic characteristics of the students and included ten key questions. The severity of TMD was categorized as no, mild, moderate or severe. The data were analysed using SPSS Version 22 (IBM, Illinois, USA). The chi-square test was used to compare the data from different groups and to determine whether the differences were statistically significant.

Results: Of those who were invited, 78 students did not return the questionnaires, whereas another 11 were excluded due to their submitting an incomplete questionnaire. A majority of the students reported no TMD (46.7%) or mild TMD (42.7%). A moderate level of TMD was reported by 8.8% of students. Only 1.7% of students reported severe TMD. No significant differences were observed in the severity of TMD in terms of student age or field of study.

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Conclusion: TMD is more prevalent among female students than male students. However, its occurrence is not affected by the age and field of study of the student.

Keywords: Fonseca's questionnaire; Students' field of study; Taibah University; Temporomandibular joint disorder; Undergraduate students

Table 1: Key questions in Fonseca's questionnaire and classification of TMD severity.

	Fonseca's key question	Yes	Sometimes	No
1.	Do you feel that it is difficult to open your mouth?			
2.	Do you feel that right and left movement of your jaw is difficult?			
3.	Do you feel muscular pain and feel tired while chewing?			
4.	Do you have headaches frequently?			
5.	Do you feel stiffness in your neck?			
6.	Do you feel pain in your ears or TMJ?			
7.	Do you hear any sounds of the TMJ clicking while chewing or opening your mouth?			
8.	Do you grind or clench your teeth?			
9.	Do you feel that your teeth do not articulate properly?			
10.	Do you feel that you are a tense or nervous person?			

Classification of TMD severity based on the key questions in Fonseca's questionnaire

Score	Category
Total between 0 and 15 points	No TMD
Total between 20 and 40 points	Mild TMD
Total between 45 and 65 points	Moderate TMD
Total between 70 and 100 points	Severe TMD

Introduction

The temporomandibular joint (TMJ) is a bilateral joint of the mandibular condyles to the skull (temporal bone).[1] It plays a functional role of moving the lower jaw during speech and mastication. Temporomandibular disorders (TMD) are commonly associated with myofascial and joint pain on opening and closing the mouth.[1] Due to the complexity of aetiological factors and management, TMD represented a matter of great concern for dental practitioners.[2,3] Several aetiological factors have been attributed to TMD, including traumatic injuries.[4] In addition, TMD is commonly related to changes in dental occlusion, including the alignment of the upper and lower teeth that affect maxilla-mandibular position and functioning.[5] Many factors such as oral habits, fatigued masticatory muscles and premature loss of natural teeth have been linked to the disorder.[6] Other important aetiological factors include emotional stress and high anxiety levels as well as stress-related symptoms, taking into consideration the high incidence of exposure to stressful life events that emphasize the contribution of such psychological parameters in the situation.[7,8]

Previous studies of various populations have reported a high prevalence of TMD. For instance, the presence of one or more TMD signs has been reported in more than 50% of non-patients, with the presence of at least one symptom being reported among more than 30% of subjects.[9,10] In addition to being higher, the prevalence varied across various populations. For example, as many as 75% of residents of Riyadh,[11] KSA had TMD signs and symptoms. Additionally, approximately 49.9% of German residents[12] and 44.4% of Dutch residents were found to have TMD.[13] It has been reported that TMD occurred more frequently among individuals in stressful situations compared to individuals who were not in stressful situations.[14] Undergraduate students at a university or college are more prone to stressful conditions.[15] It has been reported that university students are more likely to have a high risk of anxiety- and depression-related clinical disorders.[16] The high academic load may lead to subsequent stress and changes in a student's lifestyle. In addition to changes in their attitude and behaviour, such situations may adversely affect their mental health and mood and eventually increase their risk of depression.

Many studies have been published on different prevalence rates of TMD due to issues such as variations in study design and use of non-standardized diagnostic methods.[17] The prevalence of TMD with the associated complex anatomic features has put it in a diagnostically challenging category that is occasionally classified as a secondary headache disorder.[18]

The symptoms of TMD worsen over time; therefore, early diagnosis and timely management are important. Given the relationship between TMD and mental stress, it was hypothesized that TMD would be frequent among undergraduate university students who were studying in various fields. Currently, there are no published articles on this relationship among undergraduate students at Taibah University. The current study aimed to evaluate the frequency and severity of TMD among undergraduate students.

Materials and Methods

Study design

This cross-sectional study evaluated the prevalence of TMD among full-time undergraduate students using Fonseca's questionnaire. The questionnaire was originally developed by Fonseca et al.[19] and has been used in various studies[15,20,21] to assess TMD and related symptoms. The study protocol was reviewed and approved by the research ethics committee at Taibah University College of Dentistry (Ref #: TUCODREC/20151006/ZAFAR). A total of 439 male and female students (age range: 20−27 years) from

various disciplines (dentistry, engineering, medicine and pharmacy) were invited to participate. Each student was provided with the questionnaire and instructions explaining the significance and purpose of the study. Each participant returned the completed questionnaire to the investigators at their convenience. Participants with a history of previous orthodontic treatment and neurological or musculoskeletal disorders were excluded.

Data collection

The data were collected using a questionnaire that included items designed to obtain the demographic data of students (name, age, sex and discipline) and ten key questions (Table 1) derived from Fonseca's questionnaire.[19] For each key question, the participants were given three options (yes, sometimes, no). Each "yes" response was scored as 10, each "sometimes" response was scored as 5, and each "no" response was scored as 0. Hence, the collective score of each questionnaire ranged from 0 to 100. Incomplete and partially completed questionnaires were excluded. A clinical index was described on the basis of collective score of key questions (Table 1). TMD severity was categorized as no TMD (0−15), mild TMD (20−40), moderate TMD (45−65) and severe TMD (70−100). The frequency and severity of TMD were compared in terms of students' gender, age and college.

Statistical analysis

The data were analysed using SPSS Version 22 (IBM, Illinois, USA). To compare the various groups for statistical significance, the chi-square test was used. When interpreting the data, a P-value <0.05 was considered to be significant.

Results

A total of 439 students were invited to participate in this study. Of these participants, 78 students did not return the questionnaire, whereas another 11 were excluded due to their submitting an incomplete questionnaire. Hence, the results of this study are based on the data from 351 students (79.9% response rate) who returned a completed questionnaire. This included 200 (57%) male and 151 (43%) female undergraduate students. A majority of the students reported no TMD (46.7%) or mild TMD (42.7%). The frequency of mild TMD was 45.7% in female students, which was higher than in male students (40.5%); however, the difference was not statistically significant (P > 0.05). Moderate TMD was reported by 8.8% of students, whereas severe TMD was reported by only 1.7% of students (Table 2). Although the frequency of moderate and severe TMD was slightly higher in female students, there were no statistically significant differences by gender (df = 3, X^2 = 2.66, P > 0.05).

The data were further compared in relation to the age group of students (Table 3). Although the participants' responses varied, collectively, the frequency of no and mild TMD was 91.1%, 86.2% and 90% for students in the ≤21, 22−24 and 25−27 age groups, respectively. There was no significant difference based on age (P > 0.05). In contrast, severe TMD was reported in 1.8% of students aged ≤21

years and 1.7% of students aged 22−24 years, which was significantly higher than the frequency of severe TMD reported in students who were 25−27 years of age (0%) (df = 6, X^2 = 12.87, P < 0.05). While comparing the frequency of TMD among students in various colleges (Table 4), 2.6% of students in the college of dentistry and 2.4% of students in the college of pharmacy reported severe TMD, which was higher than the proportion of students in the college of medicine (1%) and college of engineering (0%). The frequency of moderate TMD was highest among engineering students (17.6%), followed by dentistry students (10.6%) and pharmacy students (7.7%). A majority of participants (82% or more) reported no or mild TMD, regardless of their discipline. There was no significant difference in no or mild TMD among students in various disciplines (P > 0.05).

Table 5 compares the responses of participants using a factorial design based on age and discipline as variables. For any college, few students (1−4%) fell into the age group 25−27 years; consequently, the TMD results from the younger age groups (≤21 years and 22−24 years) are discussed. In the college of engineering, there was no significant difference based on the age of participants. In contrast, in all the other colleges (medicine, dentistry and pharmacy), a significantly higher number of participants in the ≤21 age group reported no TMD than in the 22−24 age group (Table 5). In terms of mild TMD, there was a non-significant difference among the participants in both age groups in all colleges. The only exception was the college of medicine, as students reported a significantly higher percentage of mild TMD in the ≤21 age group (23.2%) than the 22−24 age group (1%). Although the percentages of participants in all the colleges fluctuated in terms of moderate and severe TMD, there were no significant differences among the various age groups.

Discussion

The current study reported the frequency and severity of TMD among undergraduate students at Taibah University using Fonseca's questionnaire. The response rate of participants (79.9%) was satisfactory and higher than rates reported in previous studies of various populations.[15,20,21] Well-planned survey studies with a high response rate are believed to be important research tools.[22] Although a lower response rate (43%) shows evidence of a minimum non-response bias,[23] a higher response rate (more than 70%) is believed to eliminate the risk of bias.[24−26] The higher response rate in this study is attributed to the fact that the

Table 2: Distribution and severity of TMD among university students assessed using Fonseca's questionnaire.

TMD degree	Male	Female	Total
No TMD	98 (49)	66 (43.7)	164 (46.7)
Mild TMD	81 (40.5)	69 (45.7)	150 (42.7)
Moderate TMD	19 (9.5)	12 (8)	31 (8.8)
Severe TMD	2 (1)	4 (2.6)	6 (1.7)
Total	200 (100)	151 (100)	351 (100)

The data are shown in numbers and percentages (parentheses).

Table 3: Distribution and severity of TMD among university students in various age groups.

TMD degree	<21	22−24	25−27	Total
No TMD	116 (51.6)	41 (35.3)	7 (70)	164 (46.7)
Mild TMD	89 (39.5)	59 (50.9)	2 (20)	150 (42.7)
Moderate TMD	16 (7.1)	14 (12.1)	1 (10)	31 (8.8)
Severe TMD	4 (1.8)	2 (1.7)	0 (0)	6 (1.7)
Total	225 (100)	116 (100)	10 (100)	351 (100)

The data are shown in numbers and percentages (parentheses).

questionnaire were delivered and received in person. The delivery method of questionnaires affects the response rate. For instance, a relatively poor response rate has been linked to web-based surveys.[27−29]

Fonseca's questionnaire developed by Fonseca et al.[19] and has been used in various studies[15,20,21] to assess TMD symptoms. It has been found to be a useful tool due to its benefits. For example, it is easy, quick and cost-effective.[30] In addition, it is considered to be a highly valid method for assessing TMD severity.[15] In the current study, 53.3% of participants were categorized as having mild, moderate or severe TMD, which are within the range of TMD frequencies reported in previous studies using Fonseca's questionnaire.[15,20,21] In terms of gender, a higher proportion of female students (56.3%) reported mild, moderate or severe TMD compared to male students (49%). This finding is consistent with that of Nomura et al.,[15] who also reported a higher risk of TMD in females compared to males.

TMD is a complex multifactorial condition that may be initiated by factors such as malocclusion, parafunctional habits (lip biting, bruxism)[31] and psychological factors, including anxiety or stress.[31−33] Stress and parafunctional habits are well known factors that are associated with TMD symptoms in university students.[15,31] Additionally, a

number of studies[7,20,21] has been conducted to evaluate the frequency and severity of symptoms associated with TMD. It has been reported previously that patients with no mental stress report a lower frequency of TMD compared to patients who are experiencing stress.[7,14] The stress level of university students can fluctuate, for example, during examination time or as deadlines approach. For instance, Nomura et al.[15] reported that a significant number of students with TMD (76.7%) considered themselves to be tense, whereas 71.6% of them were clenching or grinding their teeth. The conditions that affect TMD such as bruxism and clenching and grinding of teeth are directly associated with emotional stress.[34,35]

This study compared the severity of TMD among students in various age groups. The severity of TMD varied to some extent; however, there was no significant difference in terms of moderate and severe TMD among the age groups. Although ageing can be a factor that affects the severity of TMD, the age groups in this study had a narrow distribution range (3 years); therefore, they did not show any significant differences. Gray et al.[36] assessed the frequency and severity of TMD in elderly patients who were wearing complete dentures. Interestingly, despite the population, the frequency of no TMD (56.8%) was not much different than that presented in studies[15,21] conducted on undergraduate students. Similarly, comparable results have been reported for mild (40%), moderate (1.87%) and severe (1.26%) TMD.[36] These finding are suggestive of and advocate for the excellent remodelling of TMJ structures and adaptability of soft tissues. Although complex changes during the loss of natural dentition and prosthesis wear significantly change the orientation of temporomandibular tissues, TMJ adapts accordingly, thereby preventing severe TMD.

While comparing the students in various colleges, the frequency and severity of TMD was distributed randomly. Moreover, there was no significant difference among

Table 4: Distribution and severity of TMD among university students based on their college.

TMD degree	College of Engineering	College of Dentistry	College of Medicine	College of Pharmacy	Total
No TMD	14 (27.5)	53 (43.1)	70 (70.7)	27 (34.6)	164 (46.7)
Mild TMD	28 (54.9)	54 (43.9)	25 (25.3)	43 (55.1)	150 (42.7)
Moderate TMD	9 (17.6)	13 (10.6)	3 (3)	6 (7.7)	31 (8.8)
Severe TMD	0 (0)	3 (2.4)	1 (1)	2 (2.6)	6 (1.7)
Total	51 (100)	123 (100)	99 (100)	78 (100)	351 (100)

The data are shown in numbers and percentages (parentheses).

Table 5: Distribution and severity of TMD among university students by age and college.

TMD	College of Engineering			College of Dentistry			College of Medicine			College of Pharmacy			Total
Age	<21	22−24	25−27	<21	22−24	25−27	<21	22−24	25−27	<21	22−24	25−27	
No TMD	7 (13.7)	6 (11.8)	1 (2)	35 (28.5)	15 (12.2)	3 (2.4)	59 (59.6)	9 (9.1)	2 (2)	15 (19.2)	11 (14.1)	1 (1.3)	164 (46.7)
Mild	15 (29.4)	13 (25.5)	0 (0)	24 (19.5)	29 (23.6)	1 (0.8)	23 (23.2)	1 (1)	1 (1)	27 (34.6)	16 (20.5)	0 (0)	150 (42.7)
Moderate	5 (9.8)	4 (7.8)	0 (0)	5 (4.1)	7 (5.7)	1 (0.8)	2 (2)	1 (1)	0 (0)	4 (5.1)	2 (2.6)	0 (0)	31 (8.8)
Severe	0 (0)	0 (0)	0 (0)	2 (1.6)	1 (0.8)	0 (0)	1 (1)	0 (0)	0 (0)	1 (1.3)	1 (1.3)	0 (0)	6 (1.7)
Total	27 (52.9)	23 (45.1)	1 (2)	66 (53.7)	52 (42.3)	5 (4)	85 (85.9)	11 (11.1)	3 (3)	47 (60.2)	30 (38.5)	1 (1.3)	351 (100)
	51 (100)			123 (100)			99 (100)			78 (100)			351 (100)

The data are shown in numbers and percentages (parentheses); significant P-value <0.05.

engineering, dentistry and pharmacy students. These results are consistent with those of a previous study[20] in which no statistically significant differences were reported among dentistry, pharmacy, medical and physiotherapy students in terms of TMD severity. This can be attributed to the fact that, regardless of the course of study, students have variable socioeconomic backgrounds and lifestyles. The only exception in this study was that medical students had a significantly lower (29.3%) frequency of TMD compared to students in any other discipline. There is no possible scientific explanation for this finding.

It is evident from the results of this study and discussion of relevant earlier studies that a significant proportion of undergraduate university students may suffer from TMD or aggravating factors. It is important to mention that earlier diagnosis and treatment planning can prevent irreversible damage to the TMJ and improve the prognosis.[37] On the other hand, delayed diagnosis results in irreversible tissue derangement and ankyloses and requires surgical interventions.[17] Due to the complex nature and multifactorial aetiology, the diagnosis of TMD is challenging. The simplification and standardization of clinical history tools may help clinicians to diagnose TMD at earlier stages. The main limitation of the current study is that the results are based on a small sample of undergraduate students with a narrow age range (20−27 years). The questionnaires were distributed among students simultaneously (two weeks after the start of the 1st term), and completed questionnaires were collected within two weeks. It was ensured that there was no stress due to examinations, academic pressure or coursework during the data collection period. However, mental stress due to reasons such as academic pressure, examinations, meeting deadlines or personal circumstances is likely to affect TMD and warrants further investigation. In contrast, the stress level, lifestyle and socioeconomic status of the general population differ compared to university students. Hence, the prevalence and frequency of TMD reported in this study may differ for the general population and require more studies with larger samples.

Conclusions

TMD frequently occurs in undergraduate students at Taibah University, as a majority of them reported related signs. TMD is relatively more prevalent among female students. The severity of TMD is not affected by the age and field of study of the students at Taibah University. There is a need for more studies to establish a correlation between the prevalence of TMD in students and the general public.

Authors' contributions

MSZ conceived and designed the study, conducted the research and provided the research materials. WMF and NT collected, organized and interpreted the data. MSZ and ZK wrote the initial and final drafts of the article. ZK critically reviewed the manuscript. AHK performed the data analysis and statistical interpretation and wrote part of the results section. All the authors have critically reviewed and approved the final draft and are responsible for the content and similarity index of the manuscript.

Conflict of interest

The authors have no conflict of interest to declare.

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References

1. Nanci A. *Ten Cate's oral histology: development, structure, and function*. 8th ed. St. Louis, Mo.; London: Mosby; 2012.
2. Farina D, Bodin C, Gandolfi S, De Gasperi W, Borghesi A, Maroldi R. TMJ disorders and pain: assessment by contrast-enhanced MRI. **Eur J Radiol 2009**; 70: 25−30.
3. Sano T. Recent developments in understanding temporomandibular joint disorders. Part 1: bone marrow abnormalities of the mandibular condyle. **Dentomaxillofac Radiol 2000**; 29: 7−10.
4. Iizuka T, Kakudo K, Kino K, Kawano M, Kobayashi K, Koyano K. Concept and differential diagnosis for temporomandibular joint disorders. **Jpn Soc Temporomandibular Jt 2001**: 1−5.
5. De Rossi SS, Greenberg MS, Liu F, Steinkeler A. Temporomandibular disorders: evaluation and management. **Med Clin North Am 2014**; 98: 1353−1384.
6. Mehta NM. The role of interprofessional education in the management of temporomandibular and sleep disorders. **CRANIO® 2013**; 31: 159−160.
7. Pesqueira AA, Zuim PR, Monteiro DR, Ribeiro Pdo P, Garcia AR. Relationship between psychological factors and symptoms of TMD in university undergraduate students. **Acta Odontol Latinoam 2010**; 23: 182−187.
8. Pallegama R, Ranasinghe A, Weerasinghe V, Sitheeque M. Anxiety and personality traits in patients with muscle related temporomandibular disorders. **J Oral Rehabil 2005**; 32: 701−707.
9. Schiffman EL, Fricton JR, Haley DP, Shapiro BL. The prevalence and treatment needs of subjects with temporomandibular disorders. **J Am Dent Assoc 1990**; 120: 295−303.
10. Carlsson GE. Epidemiology and treatment need for temporomandibular disorders. **J Orofac Pain 1999**; 13.
11. Nassif NJ, Al-Salleeh F, Al-Admawi M. The prevalence and treatment needs of symptoms and signs of temporomandibular disorders among young adult males. **J Oral Rehabil 2003**; 30: 944−950.
12. Gesch D, Bernhardt O, Alte D, Schwahn C, Kocher T, John U, et al. Prevalence of signs and symptoms of temporomandibular disorders in an urban and rural German population: results of a population-based Study of Health in Pomerania. **Quintessence Int 2004**; 35.
13. De Kanter RJ, Truin GJ, Burgersdijk RC, Van 't Hof MA, Battistuzzi PG, Kalsbeek H, et al. Prevalence in the Dutch adult population and a meta-analysis of signs and symptoms of temporomandibular disorder. **J Dent Res 1993**; 72: 1509−1518.
14. Ebrahimi M, Dashti H, Mehrabkhani M, Arghavani M, Daneshvar-Mozafari A. Temporomandibular disorders and related factors in a group of Iranian adolescents: a cross-sectional survey. **J Dent Res Dent Clin Dent Prospects 2012**; 5: 123−127.
15. Nomura K, Vitti M, Oliveira ASd, Chaves TC, Semprini M, Siéssere S, et al. Use of the Fonseca's questionnaire to assess the prevalence and severity of temporomandibular disorders in Brazilian dental undergraduates. **Braz Dent J 2007**; 18: 163−167.

16. Bonjardim LR, Lopes-Filho RJ, Amado G, Albuquerque Jr RL, Goncalves SR. Association between symptoms of temporomandibular disorders and gender, morphological occlusion, and psychological factors in a group of university students. **Indian J Dent Res 2009**; 20: 190−194.

17. Poveda Roda R, Bagán JV, Díaz Fernández JM, Hernández Bazán S, Jiménez Soriano Y. Review of temporomandibular joint pathology: Part I: classification, epidemiology and risk factors. **Med Oral Patol Oral Cir Bucal 2007**; 12: 292−298.

18. Olesen J. The international classification of headache disorders. **Headache J Head Face Pain 2008**; 48: 691−693.

19. Fonseca DMd, Bonfante G, Valle ALd, Freitas Sérgio Fernando Torres de. Diagnóstico pela anamnese da disfunção cranio-mandibular. **RGO (Porto Alegre) 1994**; 42: 23−24, 27−28.

20. Wahid A, Imran F, Mian A, Razzaq SA, Bokhari H, Kaukab T, et al. Prevalence and severity of temporomandibular disorders (tmd) in undergraduate medical students using fon-Seca's questionnaire. **Pak Oral Dent J 2014**; 34.

21. Habib SR, Al Rifaiy MQ, Awan KH, Alsaif A, Alshalan A, Altokais Y. Prevalence and severity of temporomandibular disorders among university students in Riyadh. **Saudi Dent J 2015**; 27: 125−130.

22. Lydeard S. The questionnaire as a research tool. **Fam Pract 1991**; 8: 84−91.

23. Hovland EJ, Romberg E, Moreland EF. Nonresponse bias to mail survey questionnaires within a professional population. **J Dent Educ 1980**; 44: 270−274.

24. Evans SJ. Good surveys guide. **BMJ 1991**; 302: 302−303.

25. Brennan DS, Ryan P, Spencer AJ, Szuster FS. Dental service rates: age, period, and cohort effects. **Community Dent Health 2000**; 17: 70−78.

26. Gough HG, Hall WB. A comparison of physicians who did or did not respond to a postal questionnaire. **J Appl Psychol 1977**; 62: 777.

27. van Gelder MM, Bretveld RW, Roeleveld N. Web-based questionnaires: the future in epidemiology? **Am J Epidemiol 2010**; 172: 1292−1298.

28. Bälter KA, Bälter O, Fondell E, Lagerros YT. Web-based and mailed questionnaires: a comparison of response rates and compliance. **Epidemiology 2005**; 16: 577−579.

29. Leece P, Bhandari M, Sprague S, Swiontkowski MF, Schemitsch EH, Tornetta P, et al. Internet versus mailed questionnaires: a controlled comparison (2). **J Med Internet Res 2004**; 6: e39.

30. Campos Juliana Alvares Duarte Bonini, Goncalves DA, Camparis C, Speciali J. Reliability of a questionnaire for diagnosing the severity of temporomandibular disorder. **Braz J Phys Ther 2009**; 13: 38−43.

31. Akhter R, Morita M, Esaki M, Nakamura K, Kanehira T. Development of temporomandibular disorder symptoms: a 3-year cohort study of university students. **J Oral Rehabil 2011**; 38: 395−403.

32. Wahaj A, Hafeez K, Zafar MS. Association of bone marrow edema with temporomandibular joint (TMJ) osteoarthritis and internal derangements. **CRANIO® 2017**; 35: 4−9.

33. Jerjes W, Upile T, Abbas S, Kafas P, Vourvachis M, Rob J, et al. Muscle disorders and dentition-related aspects in temporomandibular disorders: controversies in the most commonly used treatment modalities. **Int Arch Med 2008**; 1: 23. 7682-1-23.

34. Moore DS. Bruxism, diagnosis and treatment. **J Periodontol 1956**; 27: 277−283.

35. Morse DR. Stress and bruxism: a critical review and report of cases. **J Hum Stress 1982**; 8: 43−54.

36. Gray RJ, McCord JF, Murtaza G, Siddique M. The incidence of temporomandibular disorder signs in patients wearing complete dentures compared to patients with a natural dentition. **Eur J Prosthodont Restor Dent 1997**; 5: 99−103.

37. Barone A, Sbordone L, Ramaglia L. Craniomandibular disorders and orthodontic treatment need in children. **J Oral Rehabil 1997**; 24: 2−7.