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Association of Temporomandibular Joint Dysfunction with Vestibular Insufficiency Among Health Science University Students

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Abstract

This study aims to find out the relationship of temporomandibular disorder with vestibular insufficiency. To Study the relationship of ear and balance symptoms in TMD patients such as headache, dizziness, aural fullness, tinnitus, facial pain, postural sway and dysfunction. To evaluate that the association of these two variables (if positive) have any impact on the quality of life of patients with dizziness. A cross-sectional study was conducted on the sample of 126 students of different university population. Individuals of age 18 to 27 years were included who have temporomandibular disorder symptoms and individuals with any systemic disease or trauma were excluded. Fonseca's questionnaire was used to assess the temporomandibular disorder and then two tests were performed. The one-minute full open mouth test to evaluate the degree of temporomandibular dysfunction either it is mild moderate or severe and stabile-metric test to evaluate the relationship of temporomandibular dysfunction with vestibular insufficiency. Then to analyze the study by SPSS, chi-square was applied. Results showed that $p<0.05$, value of p is less than value of **α** so that means null hypothesis is rejected and alternate hypothesis is proved. There is strong association between temporomandibular disorder and vestibular insufficiency but usually people ignore their symptoms due to lack of awareness.

Introduction

The temporomandibular joint (TMJ) is located between the temporal bone and the mandible. The adequate functioning of this joint is essential for the performance of functional movements such as speaking and chewing. Alterations in the mastication muscles, the TMJ, and/or associated structures can lead to temporomandibular disorders.(Honorato et al. 2022) The vestibular system, in vertebrates, is a sensory system that creates the sense of balance and spatial orientation for the purpose of coordinating movement with balance. Vestibular Symptoms include, vertigo, tinnitus and imbalance, ear pain or earache, a sensation of ear fullness, reduced hearing acuity or hearing loss, tinnitus, dizziness and vertigo. These symptoms mentioned above are often related to disorders of the vestibular system, whose function is to promote spatial orientation and balance of the human body.(Zeigelboim et al. 2018a) Posture is understood as the position of the human body and its orientation in space. The development of a person's posture is individual and largely dependent on the myofascial and skeletal structure and function. Maintaining a stable standing position is possible through precise neuromuscular coordination of all body segments. It requires analyzing and integrating stimuli from three systems: vision, vestibules and proprioception.(Nowak et al. 2023). A common embryologic origin of the TMJ, the lateral

pterygoid and the malleus, incus and stapes bones of the middle ear could explain some of the associations between the vestibular and TMD symptoms. Due to the common innervation of ear, the chewing muscles, the TMJ and the Eustachian tube are all innervated by mandibular branches of the trigeminal nerve and have functional neuromuscular interaction. Masticatory muscle hyperactivity could cause referred pain in the ear (Mejersjö and Pauli 2021). The prevalence of TMD in adults affects about 50% of the world population. Vestibular disorders are also prevalent in the general population, affecting 20-30% of adults. The frequency of symptomatic TMD varied from 3.4% to 65.7%, while asymptomatic TMD ranged from 3.1% to 40.8%. Prevalence of vestibular symptoms in the world population ranges from 10 to 31%, but it increases to 85% in patients with TMD. The percentages of males and females presenting with TMD are 68.1% and 72.4%, respectively.(Guimarães et al. 2023). As we know, there are many jaws related problems that may affect vestibular system but people are unaware of it that is why in most of the cases it remains undiagnosed. If a person experiences dizziness, headache or facial pain, TMJ could be the leading factor. According to the past studies such association between these two variables had only been found out in clinical setups but we conducted this research on students. Through this research we are spreading awareness on the importance of strengthening exercises of TMJ in society.

Materials and methods

Inclusion criteria	Exclusion criteria
1.All participants from18 to 27 years of age were eligible. 2.Both male and female, with a regular relationship with the institution (students with active enrollments in universities) were included. 3.The participants with vestibular symptoms coincident with temporomandibular dysfunction symptoms like facial pain, problem in chewing or pain in opening and closing of jaw. 4.Participants who signed the consent form. 5.All participants were included who scored more than 15 points in Fonseca's questionnaire.	1.People having these conditions will be excluded Congenital disorders (Micrognathia) Trauma Any systemic disease (autoimmune: Lupus) Any infectious disease that can cause facial pain (Facial Palsy)

An exploratory and cross-sectional observational study that was conducted and analyzed at one time on university students. Non-probability Convenient random sampling was used. This study was conducted at UMT and UET, UOL, UCP, Lahore where Sample of 63 males and 63 females was chosen from above mentioned universities. This study was completed within 2 months from January 2023 to March 2023 after the approval of synopsis. The sample size was 126 students. The Fonseca's questionnaire allows collecting a large quantity of information in a relatively short period and at low cost, it is easy to understand and convenient to evaluate the results. It is composed of 10 questions which include checking for the presence of pain in temporomandibular joint, head, back, and while chewing, parafunctional habits, movement limitations, joint clicking. The volunteers were informed that the 10 questions should be answered with "yes", "no" and "sometimes" and only one answer should be marked for each question. Statistical Package for Social Sciences (SPSS). SPSS

Statistics is a statistical software suite developed by IBM for data management, advanced analytics, multivariate analysis, business intelligence, and criminal investigation. We took special tests for both TMD or VS disorder (Open jaw test, stabile-metric test) from participants to get statistical data. Phenotypic characteristics such as headache, dizziness, aural fullness and facial pain whether TMD is associated with VS disorder or not were obtained from the Fonseca's Questionnaire. The Research was approved by the Research Ethics and Support Committee (RESC) of University of Management and Technology (UMT), Lahore Pakistan in which we made a commitment to abide by ethical principles, moral values, law and instruction of the institutions. Our research carries no bias for ethnicity, gender, regional aspects

Results

The above **figure 4.1** shows the frequency of age of participants in form of bar chart in which out of 126 participants, **22** had their **age less than 20**, **89** had their **age between 21 to 25** and **15 participants** had their **age above 25 (up to 27 years).**

Table 4.1 Descriptive statistics of age.

Statistics

What is your age?

N	Valid	126
Mean		1.94
Median		2.00
Std. Deviation		.541

Table: 4.2 Crosstabulation Between Difficulty in Opening Mouth and Earaches.

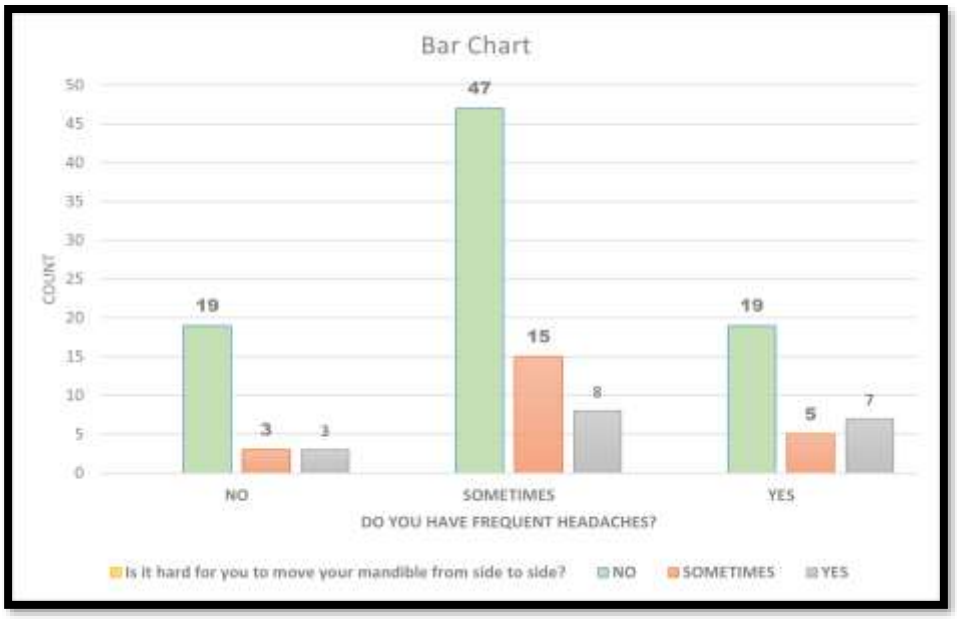
Is it hard for you to open your mouth? * Do you have earaches or pain in craniomandibular joints? Crosstabulation

Count

		Do you have earaches or pain in craniomandibular joints?			
		NO	SOMETIMES	YES	Total
Is it hard for you to open your mouth?	NO	85	18	8	111
	SOMETIMES	8	3	2	13
	YES	1	1	0	2
Total		94	22	10	126

The above **table 4.2**. shows the crosstabulation between difficulty in mouth opening and earaches. In which out of 126, **85 participants** said **they do not** face any difficulty in opening of mouth **nor** they have earaches. For **18 participants** it was **not** hard to open mouth but they **sometimes** experienced earaches. **8 participants** reported **no** difficult mouth opening but they experienced earaches. **8 sometimes** face difficulty to open mouth but **no earaches**, **3 sometimes** had difficult mouth opening as well as earaches **2 sometimes** experienced difficult mouth opening and have earaches.

Figure 4.2: Bar chart to show the cross tabulation between headaches and difficult mandibular deviation.



The above figure 2. Shows the crosstabulation between headaches and difficulty to move mandible from side to side in the form of bar chart in which **19 participants** reports that they do not have headaches or difficult mandibular deviation **3 reported** they do not have frequent headaches but sometimes have difficulty in mandibular deviation. **3 reported** they do not have frequent headaches but face difficulty to deviate mandible. **47 participants** reported they sometimes experience headaches but do not have difficult mandibular deviation **15 reported** they sometimes have frequent headaches with difficult movement of mandible from side to side and **8** sometimes have headaches with complaint of difficult mandible deviation. **19 participants** have frequent headaches but it is not hard for them to move mandible side-ways.**5** had frequent headaches but reported they sometimes face difficulty to move mandible side-ways.**7 participants** had headaches and it was hard for them to move mandible from side to side.

Do you get tired /muscular pain while chewing?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	NO	89	68.5	70.6	70.6
	SOMETIMES	31	23.8	24.6	95.2
	YES	6	4.6	4.8	100.0
	Total	126	96.9	100.0	

The above **table 4.3** shows the frequency of participants who get tired /muscular pain while chewing out of 126, **89 participants** gave answer as **no 31** reports **sometimes** and **6** gave their answer as **yes.**

Have you noticed any TMJ clicking while chewing or when you open your mouth?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	NO	86	66.2	68.3	68.3
	SOMETIMES	28	21.5	22.2	90.5
	YES	12	9.2	9.5	100.0
	Total	126	96.9	100.0	

The above **table 4.4** shows the frequency of participants who noticed TMJ clicking while chewing out of 126 participants, **86** reported their answer as **no**, **28** as **sometimes** and **12** gave their response as **yes.**

Do you have pain on the nape or stiff neck?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	NO	53	40.8	42.1	42.1
	SOMETIMES	52	40.0	41.3	83.3
	YES	21	16.2	16.7	100.0
	Total	126	96.9	100.0	

The above **table 4.5**, show The Frequency of Participants Who Experienced Neck Stiffness out of 126, **53 Participants** Gave Their Response As **NO**, **52** As **SOMETIMES** And **21** Gave Their Answer As **YES.**

Do you feel your teeth donot articulate well?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	NO	97	74.6	77.0	77.0
	SOMETIMES	19	14.6	15.1	92.1
	YES	10	7.7	7.9	100.0
	Total	126	96.9	100.0	

The above **table 4.6** shows the frequency of participants who feel their teeth do not articulate well out of 126, **97 participants** gave their response as **No, 19** as **SOMETIMES** and **10** gave their answer as **YES.**

Do you clench or grind your teeth?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	NO	80	61.5	63.5	63.5
	SOMETIMES	34	26.2	27.0	90.5
	YES	12	9.2	9.5	100.0
	Total	126	96.9	100.0	

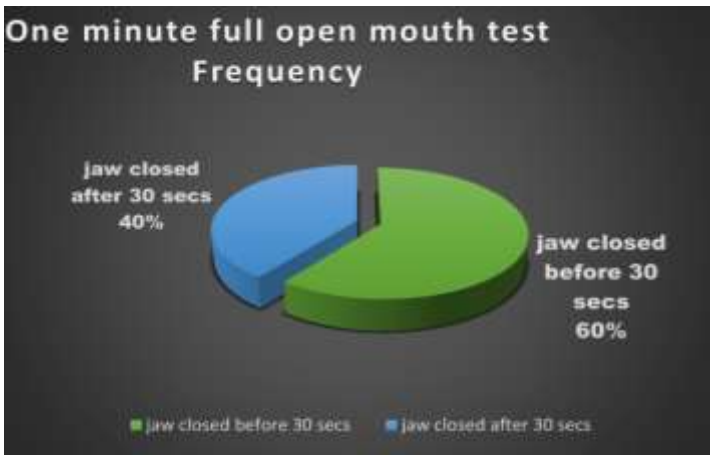
The above **table 4.7** shows the frequency of participants who clench their teeth out of 126 participants **80** gave their response as **NO, 34** as **SOMETIMES** and **12** gave their response as **YES.**

Do you consider yourself a tense (nervous) person?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	NO	36	27.7	28.6	28.6
	SOMETIMES	62	47.7	49.2	77.8
	YES	28	21.5	22.2	100.0
	Total	126	96.9	100.0	

The above **table 4.8** shows the frequency of participants who consider themselves a nervous person out of 126 participants **36** responded as **NO**, **62** as **SOMETIMES** and **28** responded as **YES**

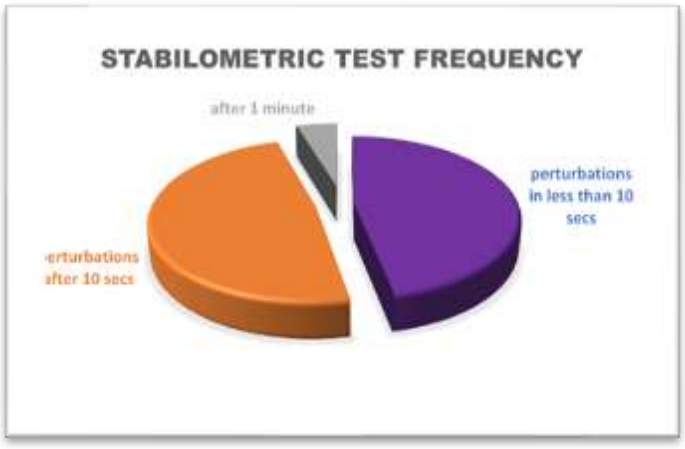
Figure: 4.3 Pie chart of one-minute open mouth test



The Above **figure 4.3**. Shows the frequency of one -minute open jaw test in the subjects in form of pie chart. Out of 126 participants jaw was closed before 30 seconds in **76 participants (60%).**

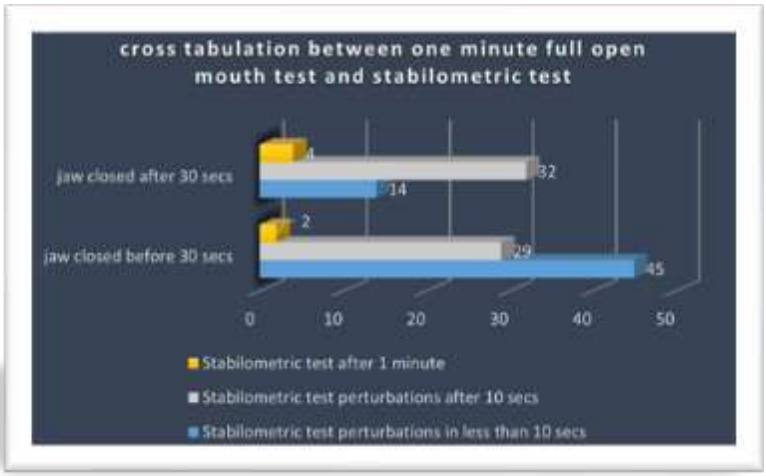
50 participants (40%) had their jaw closed after 30 seconds.

Figure 4.4 Pie chart of Stabilo-metric test



The above **figure 4.4**. Shows the frequency of stabilo-metric test in the form of pie chart. Out of 126 participants perturbations in less than 10 seconds were found in **54 participants (43%).** In **66 participants** perturbations appeared after 10 seconds **(52%)**

Figure: 4.5 Crosstabulation between one-minute full open mouth test and stabile-metric test



The above **figure 5**. Shows the cross-tabulation of stabile-metric test with one minute full open mouth test. In **45 subjects** jaw was closed before 30 seconds with perturbation in less than 10 seconds. In **29 participants** jaw was closed before 30 seconds with perturbations after 10 seconds. In **2 participants** jaw was closed before 30 seconds with perturbations after 1 minute. **14 participants** had their jaw closed after 30 seconds with perturbations in less than 10 seconds .**32** had their jaw closed after 30 seconds with perturbations after 10 seconds **4** had their jaw closed after 30 seconds with perturbations after 1 minute.

Discussion:

Temporomandibular joint dysfunction is related to vestibular symptoms but usually people are unaware of it and ignore their symptoms. In student life, generally due to overburden of study and carelessness TMD is not diagnosed and students are ignoring their symptoms. Also, these are one of the most mistreated symptoms in clinic so we chose this to further study it and to spread

awareness. A study by Thaiane de Oliveira Campos Guimarães et al.,2022 reveals that Greater degree of severity of TMD, the greater the VS, which confirms the need to evaluate both systems in symptomatic patients for each of the clinical conditions. Author conducted Cross sectional studies and took sample of students which is similar to our study but previous research used a large sample and also included teachers and employees. Fonseca's questionnaire along with two more questionnaires were used and we conducted two tests along with Fonseca 's questionnaire. Both researches are indicating a strong association of TMD and VS insufficiency but previous indicating that if severe TMD, vestibular symptoms are likely to occur. M.C.Honorato et al.,2022 found that Otalgia symptoms and aural fullness are associated with Temporomandibular Dysfunction(TMD) in patients with dizziness. These symptoms interfere with the performance of daily life activities, generating emotional, physical and functional consequences. He included just 60 sample size and done a case control study (matched with age and gender). Main symptoms included were of dizziness along with TMD to find out aural fullness and otalgia and measured through DHI questionnaire and from other tools. They concluded association between these variables and also indicated that vestibular alterations are not with temporomandibular disorders. In our research sample size was 126. We conducted an observational cross- sectional study used Fonseca questionnaire to find the presence of TMD, one- minute open jaw test to asses the severity of TMD and stabile-metric test to find whether they have vestibular insufficiency or not. Our study shows a strong association between TMD and VI. Christina Mejersjö1 | Nina Pauli2 Dec 2020 conducted a study that reveals Ear fullness was the most commonly reported symptoms affecting almost 50% of TMD patients by which they concluded Temporomandibular Dysfunction (TMD) patients with orofacial pain, dysfunction or muscle pain. This research has used sample size and age parameters which were similar to our study. Previous research conducted on patients who reported their symptoms or referred to specialist clinic with RDC/TMD questionnaire. They just considered a specific symptom of ear fullness but our research considered vestibular insufficiency which included many involved symptoms. And previous research indicated a strong association of ear fullness with TMD. Analysis by Niklas K. Edvall1 et al., 2019 confirmed that TMJ problems are closely tied to socioeconomic, phenotypic, and psychological features of individuals with tinnitus. Previous research was done through online survey and used questionnaires regarding tinnitus, But, we did cross sectional study with a questionnaire and performed two tests. They just included tinnitus from VS and associated it with TMD. They indicated greater tinnitus related burden with TMJ complaints. Our research is indicating a strong overall association of TMD and VS insufficiency. The correlation of cochleovestibular symptoms in patients with TMD is evident, thus demonstrating that the applied DHI and VADL questionnaires were sensitive in measuring the impact of dizziness on the performance of daily activities was found out Bianca S. Zeigelboima et al.,2018. Previous research included just females with a very small sample size and done transvers cohort study but we took sample from both genders with a sample size of 126 students. Previous findings were limited to prevalence among two variables causing impact on daily activities and not indicating any strong association between TMD and VS insufficiency by the use of DHI and VADL questionnaire. The presence of TMJ pain was examined during the abduction and adduction of the mandible. After stabilizing the position of the mandibular head in the articular fossa using a temporary silicone occlusal splint, TMJ pain was absent in 100% of the patients was found out by Adam Andrzej Garstka et al., 2022. Previous research included a small sample size of patients with TMD and applied RDC/TMD questionnaire. They used mouth splint and assessed TMJ pain and associated postural dysfunction. They concluded positive association among them. They just used posture with TMD but our research is concluding strong association between overall vestibular system and TMJ.

Conclusion:

The one-minute full open mouth test shows that out of 126 participants 60 percent have severe TMD and 40 percent have moderate TMD. Stabilo-metric test reveals that 43 percent had perturbations in less than 10 seconds and 52 percent had perturbations after 10 seconds. Crosstabulations and chi-square test concludes that value of p is less than α (α= o.o5) , so it show a strong association between Temporomandibular dysfunction and vestibular insufficiency.

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