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Research Article

Dental Occlusion As A Health Risk For Visual Acuity In Relation To Salivary Transforming Growth Factor Beta-1 (TGF-B1) Among Students Aged 8-10 Years

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Abstract:

Background: Correct mouth function is one of the functional matrices that contribute to the growth of the maxilla, which is connected to the growth of orbit, and vice versa.

Objective: to ascertain how dental malocclusion affects the visual acuity related salivary transforming growth factor beta-1 (TGF-β1).

Patients and Methods: This is a cross-sectional study on 653students, 8–10 years of age from elementary schools in the governorate of Al-Diwaniyah during the period from 1st of November 2022lto 30th March 2023. Using the Snellen E chart and Angle's classification to identify malocclusion, they were subjected to visual-capacity testing for refractive disorders. Sub-samples were selected from the normal and visually impaired groups for salivary transforming growth factor beta-1 salivary analysis measurement.

Results: Only 70 out of 653students were found to have reduced visual acuity. When compared to students with normal visual acuity, they had significantly higher levels of salivary transforming growth factor beta-1. Those who with reduced visual acuity were found to have a much higher occurrence of dental malocclusion utilizing molar's relation of Angle's categorization.

Conclusion: The students with impaired visual acuity were more likely to have dental malocclusions and increased levels of TGF-β1.

Keywords: Dental occlusion, health risk, visual acuity, TGF-β1, visual impairment.

Introduction:

Visual acuity (VA) is a measurement of how well the eye can distinguish between small features; it is the sharpness or clarity of vision. Visual disabilities can also affect how well children perform in school and their chances of finding employment in the future 1.

Malocclusion is described as an occlusion in which the relationship between the dental arches is abnormal in any plane of space or in which the position of the teeth deviates significantly from normal 2,3.

The continuity of anatomy between the oral and visual organs has been the focus of some investigations. The eye, nasal cavity, maxilla and external ear act as functional matrices, influencing each other under a sophisticated mechanism. Due to the maxilla's interface with every orbital bone, untreated malocclusions can cause visual issues that in turn can change the posture of the mandible 4. Based on its composition, saliva serves several functions- the features of saliva that determine its composition, such as pH, viscosity, flow rate, and buffering capability, are linked to the efficiency of these processes 5.

One of the most significant ligands involved in regulating cell behavior in ocular tissues is the multifunctional growth factor transforming growth factor beta-1 (TGF-β1). This includes regulating cell migration and proliferation, cell death, and protein synthesis during development, tissue repair, and other physiological or pathological processes. TGF-β1 typically increases the production of extracellular matrix and inhibits cell proliferation 6.

In the initial phase of dental occlusion, there is a predominant loss of subchondral bone in the TMJ condyles 7. Compressive forces applied to the TMJ could enhance the expressions of TGF-β-1 8. So far, there has been no previous Iraqi study concerning the effect of dental occlusion on visual acuity related to salivary TGF-β1.

Therefore, this study was conducted in order to assess these relationships under the hypothesis that there was

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no effect of malocclusion on visual acuity related to salivary TGF-β1.

Patients and Methods

This study is a cross-sectional study on 110 normal subjects and 70 subjects with visual impairment. These two groups were selected after examining 653 students, 8–10- years of age, recruited from elementary schools in the Governorate of Al-Diwaniyah during the period from 1st of November 2022 to 30 th March 2023. Approvals to conduct the study were obtained through the College of Dentistry's Scientific Committee at the University of Baghdad, number: 726322. Parents' consent for the complete full participation of their children in the study were obtained through a specific consent form sent to the parents prior to the commencement of the data-collecting process. The students enrolled in the study were healthy without any systemic disorders. Students who used eye-glasses, had systemic disorders, or had their first molars extracted were excluded from study.

Snellen E chart and auto-refractometer device were used in the optometrist's examination 9. A Snellen E chart was carried out to assess visual acuity at a distance of 6 meters. The students are asked to point at the letters on the various lines of the chart with each optotype's direction should to be described "up, down, to the door, or to the window". When a student can no longer discern at least half of the letters on a line that is thought to be the smallest line that they can see, both of their eyes are alternately examined. The worse eye level of reduced VA is noted. The distance at which the student starts to read the chart's largest letters is entered as the top number. If the student was not able to read the chart's largest letters he/she was excluded from the study 10,11.

Using the dental relationships of Angle's classification, dental malocclusion was assessed when the teeth were in occlusion. According to Angle's classification of the anteroposterior position of 1st molar, the following is how the upper and lower molars relate to anteroposterior:

- Class I molar relationship: The upper first permanent mesial cusp tooth occludes with the fossa of the lower first permanent molar, which denotes a typical anteroposterior connection.
- Class II molar relationships represent a retrognathic skeletal structure and imply that the lower first permanent molar and upper first permanent molar are disto-occluded.
- Class III molar relationships represent a prognathic jaw and imply a mesially positioned lower first permanent molar 12.

To assess transforming growth factor beta-1 (TGF-β1) salivary analysis was used for 90 participants, including 45 students with normal visual acuity and 45 visually impaired students who were selected randomly from the sample. On a specific case sheet, information on the student's age, gender, Angle classification, visual acuity measurements, salivary flow rate, and TGF-β1 were all recorded.

For the measurement of salivary (TGF-β1) in the morning, an unstimulated saliva sample was taken from drooling passively into a disposable gathering tube 13. An enzyme-linked immunosorbent test (ELISA) was used to identify the salivary TGF-β1.

Statistical analysis:

SPSS version 22, a statistical package for social sciences, was used for data description, analysis, and presentation. The means and standard deviations (SD) were used for quantitative variables. For qualitative variables, frequencies and percentages were utilized. The independent T-test was used to compare the means of the two groups. The Pearson correlation was used to test the correlation between two quantitative variables. $P \leq 0.05$ was used as the levels of significance.

Results

The distribution of the 653 students by the eye sides where visual acuity was tested (left and right) is shown in table 1. A significant association between visual impairment and the sides of the eyes. Eight students (1.2%) had visual acuity impairment in the right eye, seven (1.1%) in the left eye, and 55 (8.4%) in both eyes. The findings revealed an association between malocclusion on the right and left sides and the degree of visual acuity .Class I students were found to have a higher occurrence of malocclusion than those with normal visual acuity on both sides as shown in table (2). The result in table (3) provides additional evaluations of the relationship between malocclusion and visual acuity at the same sites. This table also demonstrates a strong association on both sides. Table (4) shows that students with visual impairments have significantly higher levels of salivary TGF-β1 than students with normal vision.

The descriptive statistics and statistical differences affecting malocclusion of the molar teeth and visual acuity to transform growth factor beta-1 is shown in table (5). This table shows that while the level of transforming growth factor beta-1 was greater among students with vision impairment, the changes were only appreciable among students with class II on the right side and class III on the left side.

Table 1 : Visual acuity status in relation to side affected

		Right eye		P- value
		VA Normal	VA Impairment	
Left eye	VA Normal	583 (89.3%)	8 (1.2%)	0.000
	VA Impairment	7 (1.1%)	55 (8.4%)	

*Significant P≤0.05

Table 2: Distribution of the students by Angle's classification by side and visual acuity

Angle's classification		Visual Acuity				P-value
		VA Normal		VA Impairment		
		N	%	N	%	
Right	CL Ⅰ	76	69.1	27	38.6	0.000
	CL Ⅱ	23	20.9	23	32.9	
	CL Ⅲ	11	10.0	20	28.6	
Total		110	100.0	70	100.0	
Left	CL Ⅰ	73	66.4	27	38.6	0.001
	CL Ⅱ	23	20.9	22	31.4	
	CL Ⅲ	14	12.7	21	30.0	
Total		110	100.0	70	100.0	

*Significant P≤0.05

Table 3: Distribution of the students by visual acuity by side and Angle's classification

Angle's Classification		VA Right eye				P-value	VA Left eye				P-value
		VA Normal		VA Impairment			VA Normal		VA Impairment		
		N	%	N	%		N	%	N	%	
Right	CL Ⅰ	77	65.8	26	41.3	0.004	79	66.9	24	38.7	0.001
	CL Ⅱ	26	22.2	20	31.7		26	22.0	20	32.3	
	CL Ⅲ	14	12.0	17	27.0		13	11.0	18	29.0	
Total		117	100.0	63	100.0		118	100.0	62	100.0	
Left	CL Ⅰ	74	63.2	26	41.3	0.013	77	65.3	23	37.1	0.001
	CL Ⅱ	26	22.2	19	30.2		25	21.2	20	32.3	
	CL Ⅲ	17	14.5	18	28.6		16	13.6	19	30.6	
Total		117	100.0	63	100.0		118	100.0	62	100.0	

*Significant P≤0.05

Table 4: Salivary transforming growth factor beta-1 (ng/l) (Mean±SE) in relation to visual acuity

Angle's Classification		Salivary Status	Visual Acuity				T-test	P-value
			VA Normal		VA Impairment			
			Mean	±SE	Mean	±SE		
Right	CL Ⅰ	TGF-β1	217.03	14.02	261.81	18.54	0.141*	0.057
	CL Ⅱ		210.43	25.23	314.97	29.58	0.230*	0.021
	CL Ⅲ		213.33	26.79	356.39	53.08	0.98	0.106
Left	CL Ⅰ		221.92	13.19	260.35	18.32	0.211	0.088
	CL Ⅱ		214.19	27.93	294.14	31.28	0.338	0.088
	CL Ⅲ		190.41	28.99	360.28	49.56	0.776*	0.027

*Significant P≤0.05

Table 5: Salivary transforming growth factor beta-1 (Mean±SE) according to Angle's classification by visual acuity status

Salivary Variables	Visual acuity				T-test	P-value
	VA normal		VA impairment			
	Mean	±SE	Mean	±SE		
TGF-β1	215.06	11.04	302.89	21.84	2.402 *	0.000

*Significant P≤0.05

Discussion

In the current study, among the 653 primary school students investigated, the prevalence rate of decreased VA was 10.7%. Differences in sampling techniques, operational definitions, testing population sizes, and geographic regions may be responsible for the variations in prevalence found in different studies. This prevalence was lower than found in northern Iraq 14, and those detected in other countries such as Al Hassa Region/ Saudi Arabia 15, Qassim Regions/ Saudi Arabia 16, and Qatar 17. The overall prevalence of visual impairment was higher than that found in South Africa 18, Iran 19, Malaysia 20, and Nepal 21 considerably

The differences in the percentages of unilateral versus bilateral VA impairment found in the current study are in line with earlier research 22.

In the current investigation, malocclusion was expressed using the same classification system as in an earlier study conducted at Iraq 23. Depending on the Angle's classification, the data shows that children who have poor visual acuity are more likely to suffer malocclusions. with an important association on both sides. This outcome is consistent with a study that indicated that patients with vision impairment had higher percentages of malocclusion 4.

Drooling saliva was collected using the same technique as in earlier investigations conducted in Iraq 24-29. According to a prior study, TGF-β1 activity generally increases in ocular disorders 6. Additionally, in the current investigation, children with visual acuity impairment had significantly higher levels of TGF-β1 than children with normal visual acuity. One of the elements that affect how strong the inflammatory response of this cytokine is, maybe that TGF-β1 affects host cells in a pro- and anti-inflammatory manner during the genesis and development of illness. It is a crucial mediator in the fight against inflammation, suggesting long-lasting wound healing and chronic inflammation during host responses 30. Some or all of these TGF-β1 dependent mechanisms may be involved in the start and control of tissue degradation and inflammation throughout disease processes 30-32. Due to the association between malocclusions with many factors 33 including visual acuity impairment, it is advised that visual tests be incorporated into the assessment techniques applied to the examination of the stomatognathic system.

Conclusions

A considerably higher prevalence of visual impairment was found among students affected by dental malocclusion and increased in salivary TGF-β1.

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Authors' declaration:

Conflicts of Interest: The authors declare no conflict of interest.

We confirm that all the Figures and Tables in the manuscript belong to the current study. Besides, the Figures and images, which do not belong to it have been given permission for re-publication attached to the manuscript. Authors sign on ethical consideration's approval-

Ethical Clearance: The project was approved by the local ethical committee in the University of Baghdad's internal ethics committee for dentistry according to the code number (726322),) on (Date/ Month/ Year).

Author Contributions:

The manuscript should mention the contribution of each author to the research done:

Study conception & design: (Ban S. Diab). Literature search: (Noor A. Ajeej, Ban S. Diab). Data acquisition: (Noor A. Ajeej). Data analysis & interpretation: (Noor A. Ajeej). Manuscript preparation: (Noor A. Ajeej, Ban S. Diab). Manuscript editing & review: (Noor A. Ajeej, Ban S. Diab).

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إطباق الأسنان عامل خطورة على حدة البصر وعلاقته بعامل النمو المحول اللعابي بيتا -1 (TGF- β1)بين الطلاب الذين تتراوح أعمارهم بين 8-10 سنوات

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الخلاصة
الخلفية: وظيفة الفم الصحيحة هي واحدة من المصفوفات الوظيفية التي تساهم في نمو الفك العلوي ، والتي ترتبط بنمو محجر العين، والعكس صحيح.
الأهداف: التأكد من تأثير سوء إطباق الأسنان على حدة البصر المرتبط بعامل النمو المحول اللعابي بيتا -1(TGF-β1) .
الحالات والمنهجية: هذه دراسة مقطعية على 653 طالباً ، تتراوح أعمارهم بين 8-10 سنوات من المدارس الإبتدائية في محافظة الديوانية خلال الفترة من 1 نوفمبر 2022 إلى 30 مارس 2023، وبمساعدة مخطط Snellen E وتصنيف Angle لتحديد سوء الإطباق، تم إخضاعهم لإختبار القدرات البصرية للإضطرابات الإنكسارية. تم إختيار عينات فرعية من المجموعات العادية وضعاف البصر لتحويل قياس تحليل عامل النمو المتحول بيتا -1 اللعابي.
النتائج: بينت الدراسة الحالية أن 70 فقط من أصل 653 طالباً لديهم إنخفاض في حدة البصر. عند مقارنتها بالأفراد العاديين الذين لديهم مستويات أعلى بكثير من عامل النمو المتحول بيتا -1 اللعابي ، وجد أن أولئك الذين لديهم إنخفاض في حدة البصر لديهم نسبة أعلى بكثير من سوء إطباق الأسنان بإستخدام علاقة الضرس بتصنيف الزاوية.
الإستنتاجات: أن الطلاب الذين يعانون من ضعف حدة البصر كانوا أكثر عرضة للإصابة بسوء إطباق الأسنان مع زيادة مستويات TGF-β1.
الكلمات المفتاحية: إطباق الأسنان، المخاطر الصحية، حدة البصر،TGF-β1، ضعف البصر.