

# Co-Relation between Dental Caries, Periodontitis and Severity of Myopia among Adults: A Cross-Sectional Study

Dr. Neetu Kadu<sup>1</sup>, Dr. Utkarsha Deshpande<sup>2</sup>, Wasim. A. Shaikh<sup>3</sup>, Vishal Bandgar<sup>4</sup>

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## ABSTRACT

**Background:** Oral health and ocular health are increasingly recognized as interconnected components of systemic health. Chronic oral conditions such as dental caries and periodontitis may contribute to systemic inflammatory responses that could influence ocular diseases, including myopia. However, limited evidence is available regarding the relationship between oral health status and myopia among young adults.

**Aim:** The present study aimed to evaluate the association between dental caries, periodontal status, and the severity of myopia among young adults.

**Materials and Methods:** A cross-sectional study was conducted among 150 participants aged 18–49 years. Dental caries status was assessed using the Decayed, Missing, and Filled Teeth (DMFT) index, while periodontal status was evaluated using the Community Periodontal Index of Treatment Needs (CPITN/CPI). Myopia was assessed in both eyes and categorized into low, moderate, and high myopia. Statistical analysis was performed using Pearson's and Spearman's correlation tests to determine associations between oral health parameters and myopia severity.

**Result:** A total of 150 participants were included, with a mean age of  $27.52 \pm 5.00$  years. The mean DMFT score was  $8.37 \pm 1.67$ , and the mean myopia scores were  $-8.01 \pm 3.77$  D and  $-8.63 \pm 5.03$  D for the left and right eyes, respectively. Periodontitis was present in 70.7% of participants, while 53.3% exhibited a CPI score of 3. Correlation analysis revealed significant associations among DMFT components and myopia. The level of myopia showed significant negative correlations with decayed teeth ( $r = -0.161$ ,  $p = 0.049$ ), missing teeth ( $r = -0.161$ ,  $p = 0.049$ ), filled teeth ( $r = -0.288$ ,  $p < 0.001$ ), and overall DMFT score ( $r = -0.418$ ,  $p < 0.001$ ). Spearman's correlation analysis demonstrated a significant positive correlation between myopia and periodontitis ( $r = 0.484$ ,  $p < 0.001$ ) and a significant negative correlation between myopia and CPITN score ( $r = -0.545$ ,  $p < 0.001$ ).

**Conclusion:** Significant associations were observed between dental caries, periodontal health, and myopia severity. These findings suggest a potential oral–ocular connection and warrant further longitudinal research to elucidate the underlying biological mechanisms and causal relationships.

**Key Words:** Myopia; Dental Caries; Periodontitis; Oral Health; Refractive Errors; Periodontal Diseases.

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## INTRODUCTION

Oral health is increasingly recognized as an integral component of systemic health, with chronic oral conditions such as dental caries and periodontitis contributing to inflammatory processes that extend beyond the oral cavity. Both dental caries and periodontitis are highly prevalent chronic diseases characterized by microbial infection and sustained inflammation of dental and periodontal tissues. While these conditions are well known for their direct effects on tooth structure and surrounding support, emerging evidence suggests potential associations between oral disease and ocular health outcomes.<sup>1,2</sup>

Several studies have reported associations between oral inflammatory status and eye conditions. For example, research has found that active dental caries and more severe periodontitis are associated with an increased risk of myopia in young adults, possibly reflecting underlying systemic inflammation or shared risk factors that affect both oral and ocular tissues<sup>3</sup>. Periodontitis has also been independently linked to an elevated risk of retinal vascular occlusions, supporting the concept that chronic oral inflammation may influence microvascular health in the retina<sup>4</sup>. Additionally, periodontal disease has been implicated as a potential risk factor for ocular surface disorders like dry eye disease, possibly through systemic immune-mediated mechanisms<sup>5</sup>. Other observational data suggest periodontitis may be associated with higher risks of cataract and other ocular conditions, highlighting the need for further interdisciplinary research<sup>6</sup>.

Understanding the relationship between oral diseases such as dental caries and periodontitis and ocular disorders carries important implications for integrated patient care, early diagnosis, and preventive strategies across dental and eye health discipline. The relationship between periodontitis and ocular disease is believed to involve chronic inflammation and collagen fibre destruction. Breakdown of collagen in periodontal tissues may reflect similar inflammatory pathways affecting ocular connective tissues and blood-ocular barriers<sup>7</sup>. Therefore, the present study was planned with the aim to examine the association between dental caries and periodontitis with myopia. Furthermore, inflammatory mediators released during periodontal disease may enter the systemic circulation and influence retinal and scleral tissues through immune and vascular mechanisms.<sup>8-12</sup> Therefore, the present study was planned to examine the association between dental caries, periodontitis, and myopia among young adults.

## METHODOLOGY

### *Study population*

This cross-sectional study was performed on 150 subjects. Patients visiting Choudhary Eye Care Hospital, Pune were included.

The sample size was calculated with the help of OpenEpi software taking references from the previous study.<sup>13</sup>

The inclusion criteria was those individual with age group of 18-49 yrs diagnosed with Myopia and the exclusion criteria was those individual not consenting to ocular examination, with systemic conditions and have undergone ocular surgery.

### **Clinical and demographic measurements**

Measurements of anthropometric parameters for body height and weight were calculated in standing position. Name, Age, Gender of the patient was noted.

### **Dental caries and periodontitis condition measurements;**

A disposable mouth mirror and community periodontal probe were used for examination of the teeth. The numbers of decayed, missing and filled teeth (DMFT) was assessed according to standards defined by the World Health Organization (WHO, 2013). Teeth having damaged surface, pits, teeth showing blackish discoloration, damaged surfaces or pits and grooves, cavitated enamel and softened surfaces (detected by the probe) were considered to be actively dental caries. Any tooth that was filled but had secondary caries were considered as active dental caries. Teeth having faulty sealants were regarded as actively dental caries. Filled teeth were defined as healing dental caries which have undergone complete treatment and without recurrence. Impacted teeth and third molars were not considered in this study.

Full mouth periodontal condition was recorded at six different sites of each tooth, including probing pocket depth (PPD) and clinical attachment loss and also data on the remaining teeth numbers, tooth mobility, furcation involvement and full mouth radiographic images were collected. The above clinical examination was performed under sterile environment and the necessary infection control norms were followed accordingly.

### **Ocular status measure**

The auto kerato refract meter was used for clinical examination of the subject and a Snelles chart was also used to assess the subjects best corrected visual acuity. Patients with prescreening extreme Myopia, amblyopia, strabismus, a history of high risk ocular surgery and pathology affecting the clarity of the ocular media are the excluding criteria.

The severity of myopia was graded as

No myopia - > 0.5 diopter

Low myopia - -0.5 to -5.9 diopter

High myopia - < -6.0 diopters

**Statistical analysis:** Data obtained was entered in MS Excel (2013). Descriptive analysis was performed. Correlation analysis was performed to assess the strength and direction of the relationship between the study variables. Depending on the distribution and nature of the data, either Pearson's correlation coefficient (for DMFY) and Spearman's rank correlation coefficient (for Periodontitis and CPI) was applied. Correlation coefficients (r) were calculated to determine the magnitude and direction of the association between variables. All the analyses were performed using IBM SPSS version 25

## RESULTS

A total of 150 participants were included in the present study. The mean age of the participants was  $27.52 \pm 5.00$  years, with the age ranging from 18 to 49 years. The mean number of decayed teeth was  $4.28 \pm 1.10$ , while the mean number of missing and filled teeth was  $0.90 \pm 1.20$  and  $3.19 \pm 1.14$ , respectively. The overall mean DMFT score was  $8.37 \pm 1.67$ , indicating a relatively high caries experience among the study participants. The mean myopia score was  $-8.01 \pm 3.77$  diopters for the left eye and  $-8.63 \pm 5.03$  diopters for the right eye, suggesting the presence of moderate to severe

myopia among the participants. (Table 1)

With respect to gender distribution, 70% of the participants were males and 30% were females. Periodontitis was present in 70.7% of the study population, whereas 29.3% did not exhibit periodontitis. Assessment of periodontal status using CPI scores revealed that the majority of participants (53.3%) had CPI score 3, followed by CPI score 2 (24%), CPI score 4 (17.3%), and CPI score 1 (5.3%). Based on the level of myopia, 74% of participants had low myopia, 19.3% had moderate myopia, and 6.7% had high myopia. (table 2)

Correlation analysis as mentioned in Tables 3 and 4, demonstrated significant associations between dental caries experience and level of myopia. Decayed teeth showed a significant positive correlation with missing teeth ( $r = 0.246, p = 0.002$ ) and DMFT score ( $r = 0.558, p < 0.001$ ), while a significant negative correlation was observed with filled teeth ( $r = -0.407, p < 0.001$ ). Missing teeth were strongly positively correlated with DMFT score ( $r = 0.684, p < 0.001$ ). Filled teeth also demonstrated a weak but statistically significant positive correlation with DMFT score ( $r = 0.208, p = 0.011$ ).

The level of myopia showed statistically significant negative correlations with decayed teeth ( $r = -0.161, p = 0.049$ ), missing teeth ( $r = -0.161, p = 0.049$ ), filled teeth ( $r = -0.288, p < 0.001$ ), and overall DMFT score ( $r = -0.418, p < 0.001$ ). These findings indicate that increasing severity of myopia was associated with lower dental caries experience, with the strongest association observed for the overall DMFT score.

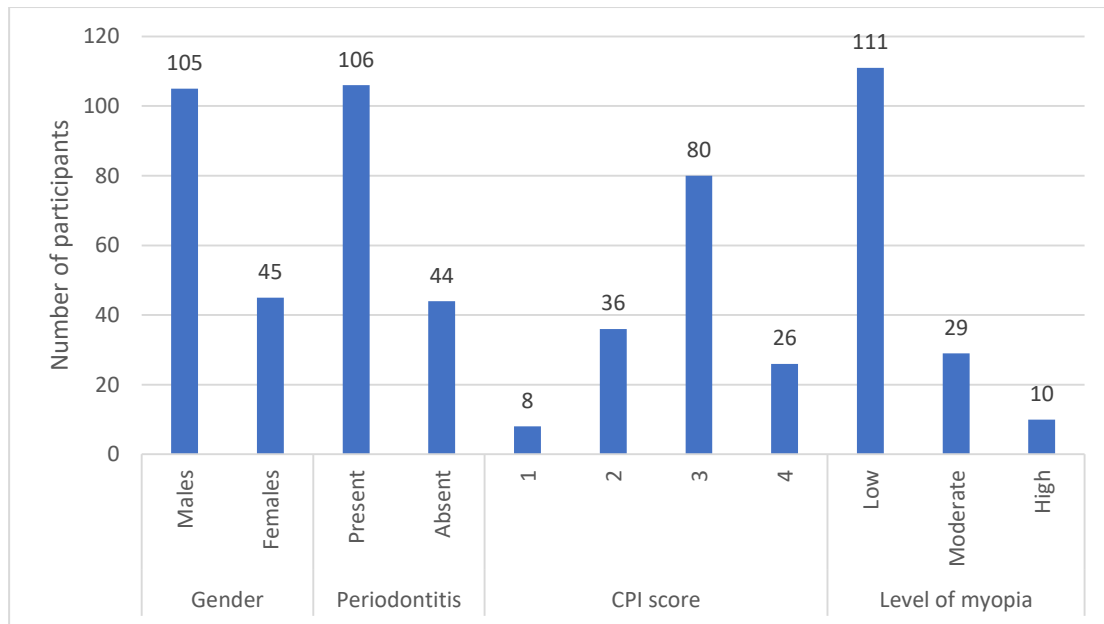
Spearman's correlation analysis between periodontal status and myopia revealed a strong negative correlation between periodontitis and CPITN score ( $r = -0.845, p < 0.001$ ). Myopia of the left eye demonstrated a statistically significant moderate positive correlation with periodontitis ( $r = 0.484, p < 0.001$ ), whereas a significant negative correlation was observed with CPITN score ( $r = -0.545, p < 0.001$ ). These findings suggest a significant association between severity of myopia and periodontal health status among the study participants. (Table 4)

**Table 1: Mean values of demographic variables, DMFT and myopia**

	N	Minimum	Maximum	Mean	Std. Deviation
Age	150	18.00	49.00	27.52	5.00
Decayed	150	2.00	7.00	4.28	1.10
Missing	150	.00	4.00	0.90	1.20
Filled	150	.00	6.00	3.19	1.14
DMFT	150	5.00	12.00	8.37	1.67
Myopia left eye	150	-20.80	-1.50	-8.01	3.77
Myopia right eye	150	-50.00	-1.80	-8.63	5.03

**Table 2: Distribution of study participants according to gender, periodontitis, CPI score and level of myopia**

		Frequency	Percent
Gender	Males	105	70
	Females	45	30
Periodontitis	Present	106	70.7
	Absent	44	29.3
CPI score	1	8	5.3
	2	36	24
	3	80	53.3
	4	26	17.3
Level of myopia	Low	111	74
	Moderate	29	19.3
	High	10	6.7



**Figure 1: Demographic characteristics of study participants**

**Table 3: Correlation between severity of myopia and DMFT status**

		decayed	missing	filled	DMFT	level of myopia
decayed	Pearson Correlation	1	.246**	-.407**	.558**	-.161*
	P value		.002	.000	.000	.049
	N	150	150	150	150	150
missing	Pearson Correlation	.246**	1	-.287**	.684**	-.161*
	P value	.002		.000	.000	.049
	N	150	150	150	150	150
Filled	Pearson Correlation	-.407**	-.287**	1	.208*	-.288**
	P value	.000	.000		.011	.000
	N	150	150	150	150	150
DMFT	Pearson Correlation	.558**	.684**	.208*	1	-.418**
	P value	.000	.000	.011		.000
	N	150	150	150	150	150
severity of myopia	Pearson Correlation	-.161*	-.161*	-.288**	-.418**	1
	P value	.049	.049	.000	.000	
	N	150	150	150	150	150

\*\* . Correlation is significant at the 0.01 level (2-tailed).

\* . Correlation is significant at the 0.05 level (2-tailed).

**Table 4: Correlation between Severity of Myopia and Periodontal findings**

		Periodontitis	CPITN
Severity of myopia	Correlation Coefficient	.480**	-.442**
	p value	.000	.000
	N	150	150

\*\* . Correlation is significant at the 0.01 level (2-tailed).

## DISCUSSION

The present study was conducted to evaluate the association between dental caries, periodontal status, and myopia among young adults. A total of 150 participants with a mean age of  $27.52 \pm 5.00$  years were included. The findings demonstrated significant relationships between oral health parameters and the severity of myopia.

The overall mean DMFT score of  $8.37 \pm 1.67$  indicated a relatively high prevalence of dental caries among the study population. Among the components of DMFT, the mean decayed teeth score ( $4.28 \pm 1.10$ ) was higher than the missing teeth score ( $0.90 \pm 1.20$ ), suggesting that untreated dental caries was common among participants. This observation is consistent with previous epidemiological studies reporting high caries prevalence in young adults due to dietary habits, inadequate oral hygiene practices, and limited preventive dental care.

The majority of participants were males (70%), and periodontitis was present in 70.7% of the study population. CPI score 3 was the most commonly observed periodontal condition, indicating the presence of periodontal pockets and compromised periodontal health in a substantial proportion of individuals. These findings suggest that periodontal disease is highly prevalent among young adults and may coexist with systemic or ocular conditions such as myopia. Regarding ocular status, the mean myopia scores for the left and right eyes were  $-8.01 \pm 3.77$  D and  $-8.63 \pm 5.03$  D, respectively, indicating moderate to severe myopia among participants. Although the majority of subjects were categorized as having low myopia (74%), a considerable proportion exhibited moderate (19.3%) and high myopia (6.7%). The increasing prevalence of myopia among young adults has been attributed to prolonged near-work activities, excessive screen exposure, reduced outdoor activity, and genetic predisposition.

Correlation analysis revealed significant associations between dental caries parameters and myopia severity. Decayed teeth, missing teeth, filled teeth, and overall DMFT scores showed statistically significant negative correlations with the level of myopia. The strongest correlation was observed between DMFT score and myopia ( $r = -0.418$ ,  $p < 0.001$ ). These findings suggest that individuals with greater myopia severity demonstrated comparatively lower dental caries experience. A possible explanation may be that highly myopic individuals are more health-conscious, seek regular healthcare, or maintain better oral hygiene practices. Another possibility is that lifestyle and behavioral factors associated with myopia may indirectly influence oral health patterns.

The study also demonstrated significant interrelationships among DMFT components. Decayed teeth showed a positive correlation with missing teeth and DMFT scores, while filled teeth showed a negative correlation with decayed teeth. This reflects the natural progression of dental caries, where untreated decay may eventually lead to tooth loss, whereas restorative treatment reduces the number of active carious lesions. Similar findings were reported by Tsai et al.<sup>13</sup> and Goldstein et al.<sup>14</sup>, who observed significant associations between oral health status and myopia. The observed relationship among DMFT components is also consistent with the established understanding that chronic oral diseases are cumulative in nature and contribute to long-term deterioration of oral health.<sup>1,2</sup> Furthermore, increasing evidence suggests that oral inflammatory conditions may influence systemic health through inflammatory mediators, vascular changes, and immune pathways that may affect ocular tissues and visual health.<sup>4-7</sup> Pockpa et al.<sup>7</sup> proposed that periodontal diseases and ocular diseases may share common inflammatory mechanisms, including connective tissue degradation, collagen fibre destruction, oxidative stress, and dysregulation of host immune responses. These mechanisms may provide a biological explanation for the observed associations between oral health parameters and myopia in the present study. Therefore, the positive association between untreated caries, tooth loss, and overall DMFT scores observed in the present study reflects not only the natural progression of dental disease but also the potential systemic impact of chronic oral inflammation.

An important finding of the present study was the association between periodontal status and myopia. Myopia of the left eye showed a moderate positive correlation with periodontitis ( $r = 0.484$ ,  $p < 0.001$ ) and a significant negative correlation with CPITN score ( $r = -0.545$ ,  $p < 0.001$ ). These findings indicate a possible relationship between ocular and periodontal health. Chronic periodontal inflammation may contribute to systemic inflammatory responses, vascular changes, and immune dysregulation that could influence ocular tissues. Previous studies have suggested that inflammatory mediators released during periodontal disease may play a role in ocular pathologies through systemic circulation.

The strong negative correlation observed between periodontitis and CPITN score ( $r = -0.845$ ,  $p < 0.001$ ) may reflect differences in coding or categorization methods used during data analysis. Nevertheless, the results collectively emphasize the importance of evaluating oral health as a component of overall systemic and ocular health. Similar observations have been reported by Pihlstrom et al.<sup>1</sup>, who highlighted the systemic inflammatory burden associated with periodontal disease, and by Sharma et al.<sup>4</sup>, who demonstrated a significant association between periodontitis and retinal vascular disorders. Furthermore, Pockpa et al.<sup>7</sup> proposed a potential biological link between periodontal and ocular diseases through shared inflammatory pathways, connective tissue degradation, collagen fibre destruction, and immune-mediated mechanisms. The findings of the present study support these observations and further suggest that chronic periodontal inflammation may contribute to ocular alterations through systemic dissemination of inflammatory mediators and vascular changes, thereby reinforcing the concept of an oral-ocular connection. The findings of the present study support the growing concept of an oral-ocular connection.

Oral diseases, particularly periodontal disease, are chronic inflammatory conditions capable of influencing distant organs through microbial dissemination, inflammatory mediators, and immune pathways. Although the exact biological mechanism linking myopia and oral health remains unclear, the observed associations highlight the need for interdisciplinary research between dentistry and ophthalmology.

However, certain limitations should be considered while interpreting the results. The cross-sectional design of the study does not establish causality between oral health parameters and myopia. The sample size was relatively limited, and the study population may not represent the general population. Additionally, factors such as socioeconomic status, dietary habits, oral hygiene practices, screen time, genetic predisposition, and environmental influences were not extensively evaluated and could act as confounding variables. Despite these limitations, the study provides valuable preliminary evidence regarding the association between dental caries, periodontal health, and myopia. Further longitudinal and multicenter studies with larger sample sizes are recommended to clarify the underlying mechanisms and establish causal relationships between oral and ocular health conditions.

### CONCLUSION

Overall, the study findings suggest significant associations between dental caries status, periodontal health, and severity of myopia among the study participants. The study demonstrated significant associations between dental caries experience, periodontal health, and myopia severity among young adults. These findings support the concept of an oral-ocular connection and highlight the importance of interdisciplinary approaches involving dentistry and ophthalmology. Further longitudinal studies are recommended to establish causal relationships and explore the underlying biological mechanisms linking oral and ocular health.

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