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Comparative Evaluation Of Malocclusion, Dental Caries, And Oral Hygiene Status In Government And Private School Children Aged -12 To 15 Years- A Descriptive Cross-Sectional Study.

Dr. Neetu Kadu, Dr. Utkarsha Deshpande, Shifa Shaikh,
Touheed Ahmad Siddiqui
(Head Of Department And Reader, Department Of Public Health Dentistry, M. A. Rangoonwala College Of Dental Sciences And Research Centre, Pune – 01, Maharashtra, India)
(Senior Lecturer, Department Of Public Health Dentistry, M. A. Rangoonwala College Of Dental Sciences And Research Centre, Pune – 01, Maharashtra, India)
(Interns, Department Of Public Health Dentistry, M. A. Rangoonwala College Of Dental Sciences And Research Centre, Pune – 01, Maharashtra, India)

Abstract
Background
Oral health problems such as dental caries, malocclusion, and poor oral hygiene are common among school children and are influenced by socioeconomic factors. Comparing government and private school children helps evaluate differences in oral health status and access to dental care.
Aim
To compare and evaluate malocclusion, dental caries experience, and oral hygiene status among government and private school children aged 12–15 years in Pune, Maharashtra.
Materials and Methods
A descriptive cross-sectional comparative study was conducted among 273 school children aged 12–15 years, including 136 government school children and 137 private school children. Participants were selected using a multistage cluster random sampling technique. Oral hygiene status was assessed using the Oral Hygiene Index–Simplified (OHI-S), dental caries experience was recorded using the Decayed, Missing, and Filled Teeth (DMFT) index according to World Health Organization criteria, and malocclusion severity was evaluated using the Dental Aesthetic Index (DAI). Statistical analysis was performed using IBM SPSS Statistics version 26.0. Independent sample t-test, Pearson correlation coefficient analysis, and multiple linear regression analysis were applied. Statistical significance was considered at $p < 0.05$*.*
Results
Government school children demonstrated significantly higher mean OHI-S scores (3.14 ± 0.48), DMFT scores (4.13 ± 1.49), and DAI scores (33.61 ± 3.87) compared to private school children, who exhibited mean OHI-S, DMFT, and DAI scores of 1.02 ± 0.35, 2.34 ± 1.21, and 21.33 ± 3.92 respectively ($p < 0.001$*). Government school children also showed significantly higher decayed and missing teeth scores, whereas private school children demonstrated significantly higher filled teeth scores. Correlation analysis revealed a strong positive association between DAI and OHI-S scores (*$r = 0.803$*,* $p < 0.001$*) and a moderate positive association between DAI and DMFT scores (*$r = 0.473$*,* $p < 0.001$*). Multiple linear regression analysis demonstrated that oral hygiene status and caries experience significantly contributed to malocclusion severity in the overall study population.*
Conclusion
Government school children exhibited poorer oral hygiene status, greater dental caries experience, and increased malocclusion severity compared to private school children. The study findings highlight the influence of socioeconomic disparities on oral health outcomes and emphasize the need for targeted school-based oral health education, preventive interventions, and early orthodontic screening programs, particularly among socioeconomically disadvantaged children.
Keywords: *Malocclusion; Dental caries; Oral hygiene; DAI; DMFT; OHI-S; School children; Cross-sectional study.*

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I. Introduction

Oral health is an essential component of general health and significantly influences the overall well-being and quality of life of children and adolescents. Dental caries, malocclusion, and poor oral hygiene are among the most common oral health problems affecting school-aged children worldwide.[1,2] Dental caries remains a highly prevalent multifactorial disease influenced by dietary habits, oral hygiene practices, socioeconomic status, and access to dental care.[3,4] Children from lower socioeconomic backgrounds are often more susceptible to untreated dental diseases due to limited awareness and reduced accessibility to preventive dental services.[5]

Malocclusion is another important oral health concern during adolescence and may adversely affect esthetics, oral function, psychological well-being, and maintenance of oral hygiene.[6,7,8] Poor oral hygiene further contributes to plaque accumulation, increasing the risk of dental caries and periodontal diseases.[9] Differences in socioeconomic and educational backgrounds between government and private school children may lead to variations in oral health status and treatment needs.[4,10]

Although previous studies have evaluated dental caries, malocclusion, and oral hygiene separately, limited literature is available comparing these oral health parameters simultaneously among government and private school children.[4,11,12]. Therefore, the present study was conducted to comparatively assess malocclusion, dental caries, and oral hygiene status among children aged 12–15 years studying in government and private schools, and to evaluate the association between malocclusion severity and oral health status.

II. Methodology

Study design

This is a descriptive cross-sectional comparative study that was conducted among 273 school-going children aged 12–15 years in Pune, Maharashtra, India, including students who were present on the day of examination.

Sample size calculation

The sample size was calculated using OpenEpi software version 3.0 with a 95% confidence level, 5% absolute precision, and a design effect of 1. The minimum required sample size was determined to be 273 participants; therefore, 273 school-going children were included in the study.[1]

Sampling technique

A multistage cluster random sampling technique was employed. Pune city was geographically divided into four zones: East, West, North, and South. In the first stage, one administrative ward was randomly selected from each zone. In the second stage, two schools (one government and one private) were randomly selected from each chosen ward. In the third stage, eligible students from the selected schools were recruited using class attendance registers.

Inclusion and exclusion criteria

Children aged 12–15 years whose parents/guardians provided informed consent and who were cooperative during the oral examination were included in the study. Children undergoing orthodontic treatment, wearing fixed or removable orthodontic appliances, having fixed prostheses, crowns, or overhanging restorations affecting occlusal assessment, those with systemic diseases or on long-term medication, and physically or medically compromised children were excluded from the study.

Data collection

The study proforma consisted of two sections:
Part I: Questionnaire
A pre-designed and pre-tested questionnaire was used to collect demographic details. including age, gender.

Part II: Clinical examination
Oral examinations were conducted to record:
1. Oral hygiene status using the Oral Hygiene Index–Simplified (OHI-S)[9]
2. Dentition status using the WHO Oral Health Assessment Form (2013)[5]
3. Dentofacial anomalies and malocclusion using the Dental Aesthetic Index (DAI) as per WHO criteria[8]

Examination procedure

The examiner visited the selected schools on scheduled dates. Children were seated comfortably on a chair and examined under natural daylight using the Type III examination method[5]. The assistant recorded the findings as dictated by the examiner. Sterile mouth mirrors and probes were used for examination. The examiner wore disposable gloves and masks during all examinations.

Statistical Analysis

The collected data were entered into Microsoft Excel and analyzed using Statistical Package for Social Sciences (IBM SPSS Statistics for Windows, Version 26.0; IBM Corp., Armonk, NY, USA). Descriptive statistics were calculated in the form of mean, standard deviation, frequency, and percentage. Independent sample t-test was used to compare the mean Oral Hygiene Index–Simplified (OHI-S), Decayed Missing Filled Teeth (DMFT), and Dental Aesthetic Index (DAI) scores between government and private school children. Pearson's correlation coefficient analysis was performed to determine the relationship between malocclusion severity and oral health variables. Multiple linear regression analysis was further carried out to identify predictors associated with DAI scores. Statistical significance was considered at $p < 0.05$, while $p < 0.001$ was considered highly statistically significant.

III. Results

A total of 273 school children aged 12–15 years participated in the study, comprising 136 government school children and 137 private school children. The mean age of participants in government schools was 13.33 ± 1.04 years, whereas the mean age among private school children was 13.64 ± 1.08 years. The gender distribution was nearly equal in both Government and Private school groups. In Government schools, females constituted 48.5% and males 51.5%, while in Private schools, females accounted for 49.6% and males 50.4%.

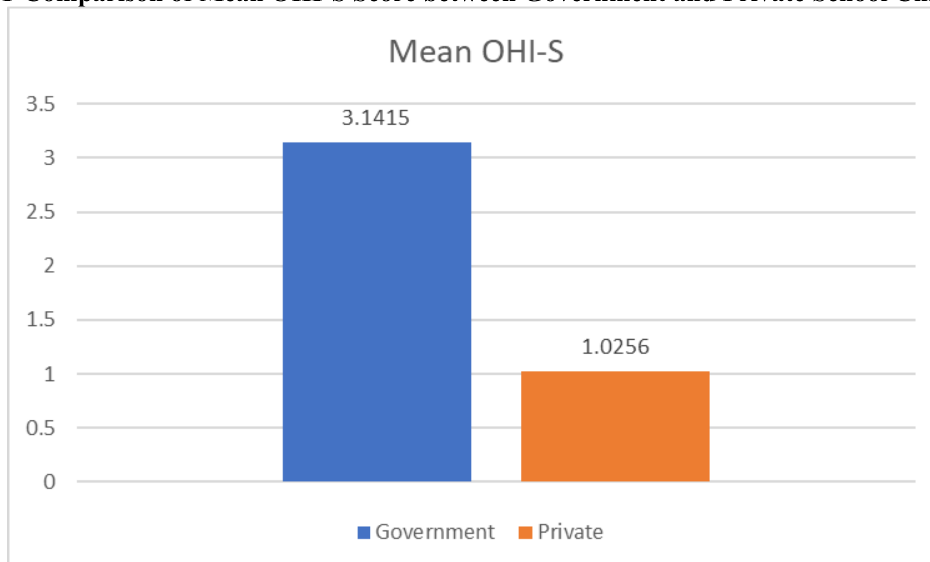
Table no.1 - Comparison of Mean DI-S and CI-s and OHI-S Score between Government and Private School Children

	School	N	Mean	Std. Deviation	P value
DI-S	Government	136	1.8715	.35963	<0.001**
	Private	137	.6313	.23765	
CI-S	Government	136	1.2700	.28948	<0.001**
	Private	137	.3943	.25421	
OHI-S	Government	136	3.1415	.48749	<0.001**
	Private	137	1.0256	.35429	

independent sample t test. P- value < 0.001**

The mean DI-S score was significantly higher among Government school children (1.87 ± 0.35) compared to Private school children (0.63 ± 0.23), with a highly statistically significant difference ($p < 0.001$). Similarly, the mean CI-S score was also significantly higher in Government school children (1.27 ± 0.28) than in Private school children (0.39 ± 0.25), with $p < 0.001$. Similarly, the mean OHI-S score was markedly higher in government school children (3.14 ± 0.48) than in private school children (1.02 ± 0.35), indicating poorer oral hygiene status among children attending government schools. (Table no. 1 , Fig. 1)

Fig.1-Comparison of Mean OHI-S Score between Government and Private School Children



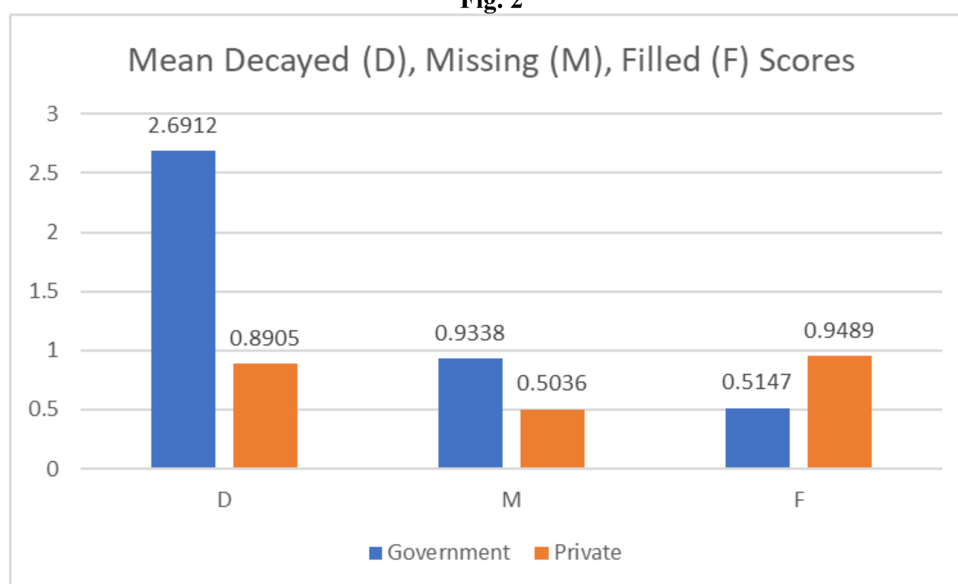
The mean OHI-S score was significantly higher in Government school children (3.14 ± 0.48) compared to Private school children (1.02 ± 0.35), and this difference was highly statistically significant ($p < 0.001$). (Fig.1)

Table no.2 - Comparison of Mean Decayed (D), Missing (M) and Filled (F) scores between Government and Private School children

	School	N	Mean	Std. Deviation	P value
D	Government	136	2.6912	1.15800	<0.001**
	Private	137	.8905	.82852	
M	Government	136	.9338	.77174	<0.001**
	Private	137	.5036	.50182	
F	Government	136	.5147	.50163	<0.001**
	Private	137	.9489	.84297	

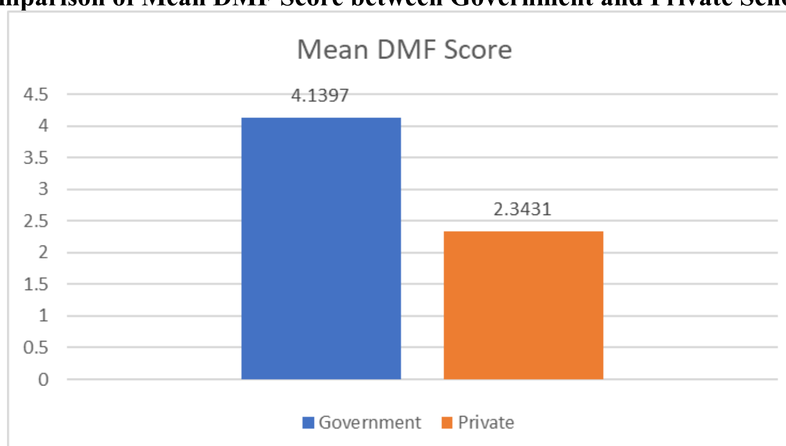
independent sample t test. P- value <0.001**

Fig. 2



The mean decayed (D) score was significantly higher in Government school children (2.69 ± 1.15) compared to Private school children (0.89 ± 0.82), with $p < 0.001$, indicating a greater burden of untreated dental caries. Similarly, the missing (M) component was higher in Government school children (0.93 ± 0.77) than in Private school children (0.50 ± 0.50), with a statistically significant difference ($p < 0.001$), suggesting higher tooth loss in the Government group. In contrast, the filled (F) score was significantly higher among Private school children (0.94 ± 0.84) compared to Government school children (0.51 ± 0.50), with $p < 0.001$, indicating better access to dental treatment and restorative care in Private school children. (Table no. 2, fig. 2)

Fig.3 - Comparison of Mean DMF Score between Government and Private School Children



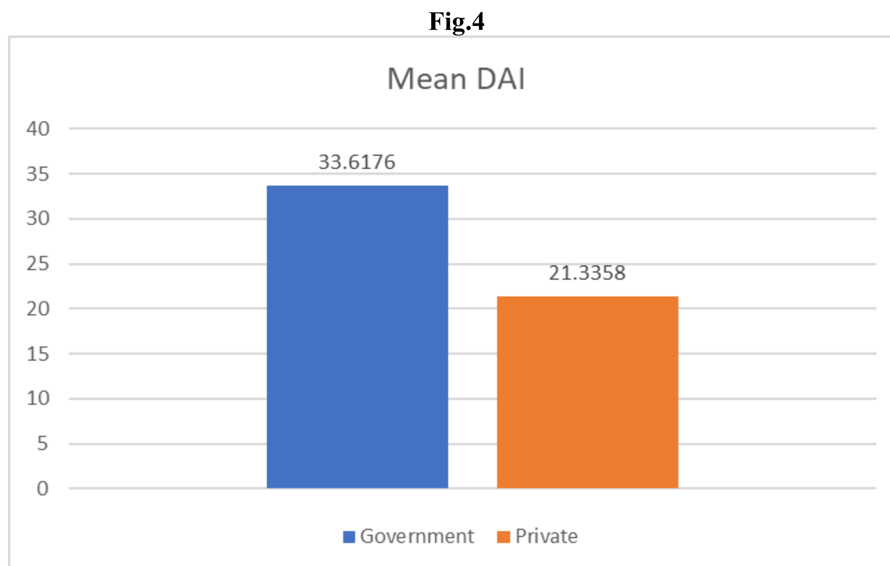
The mean DMF score was significantly higher in Government school children (4.13 ± 1.49) compared to Private school children (2.34 ± 1.21), with a highly statistically significant difference ($p < 0.001$). (Fig.3)

Table no.3 - Comparison of Mean DAI Score between Government and Private School Children

	School	N	Mean	Std. Deviation	p value
DAI	Government	136	33.6176	3.87023	<0.001**
	Private	137	21.3358	3.92068	

independent sample t test. P- value <0.001**

Fig.4



The mean DAI score was significantly higher in Government school children (33.61 ± 3.87) than in Private school children (21.33 ± 3.92), with $p < 0.001$, indicating greater severity of malocclusion among government school children. (Table no.3, fig.4)

Table no.4- Correlation of DAI, OHIS, D, M, F and DMF scores of all the participants

Correlations		DAI	OHI-S	D	M	F	DMF
Pearson Correlation	DAI	1.000	.803	.581	.261	-.265	.473
	OHI-S	.803	1.000	.633	.283	-.268	.524
	D	.581	.633	1.000	.202	-.231	.811
	M	.261	.283	.202	1.000	-.086	.549
	F	-.265	-.268	-.231	-.086	1.000	.219
	DMF	.473	.524	.811	.549	.219	1.000
P value	DAI	.	<0.001	<0.001	<0.001	<0.001	<0.001
	OHI-S	<0.001	.	<0.001	<0.001	<0.001	<0.001
	D	<0.001	<0.001	.	<0.001	<0.001	<0.001
	M	<0.001	<0.001	<0.001	.	.079	<0.001
	F	<0.001	<0.001	<0.001	.079	.	<0.001
	DMF	<0.001	<0.001	<0.001	<0.001	<0.001	.

DAI showed a strong positive correlation with OHI-S ($r = 0.803$, $p < 0.001$), indicating that poorer oral hygiene status was strongly associated with increased malocclusion severity. A moderate positive correlation was observed between DAI and D component ($r = 0.581$, $p < 0.001$), suggesting that higher levels of untreated dental caries were associated with higher DAI scores. A weak positive correlation was found between DAI and M component ($r = 0.261$, $p < 0.001$), indicating a relatively smaller contribution of missing teeth to malocclusion severity. In contrast, DAI exhibited a weak negative correlation with F component ($r = –0.265$, $p < 0.001$), suggesting that an increase in filled teeth (indicative of treated caries) was associated with slightly lower DAI scores. Furthermore, DAI showed a moderate positive correlation with overall DMF index ($r = 0.473$, $p < 0.001$), indicating that cumulative caries experience was associated with increased malocclusion severity. (Table no. 4).

Table no.5 - Multiple Linear Regression analysis for DAI,DMF,OHIS for all participants

Model Summary[b]									
1	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df1	df2	Sig. F Change
	.810[a]	.657	.652	4.29642	.657	128.128	4	268	<0.001
a. Predictors: (Constant), DMF, F, M, OHI-S									
b. Dependent Variable: DAI									

The overall regression model was found to be statistically significant ($F = 128.128$, $p < 0.001$), indicating that the selected independent variables collectively had a significant effect on DAI. The model demonstrated a high coefficient of determination ($R^2 = 0.657$), suggesting that 65.7% of the variability in DAI scores could be explained by the included predictors.

Based on the correlation trends, OHI-S and DMF components appear to be major contributors to DAI variation, while individual components such as M and F show relatively weaker associations.

Overall, the findings indicate that oral hygiene status and caries experience are significant determinants of malocclusion severity, as measured by DAI. Poor oral hygiene and higher untreated caries levels were associated with increased DAI scores, while treated caries (filled teeth) showed a slight protective association. The regression model demonstrated strong predictive ability, explaining a substantial proportion of variability in DAI, thereby highlighting the importance of preventive and restorative oral health measures in reducing malocclusion severity. (Table no.5, fig.5,6)

Fig.5

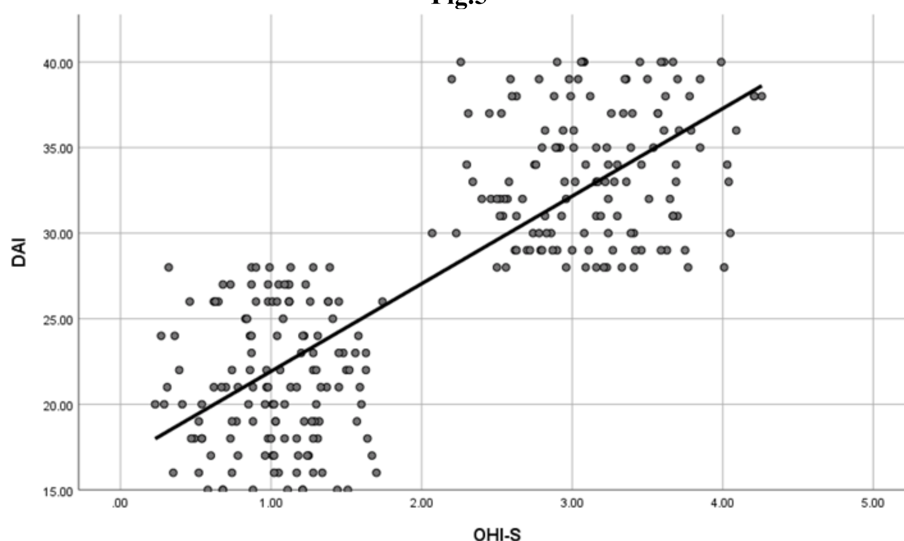


Fig.6

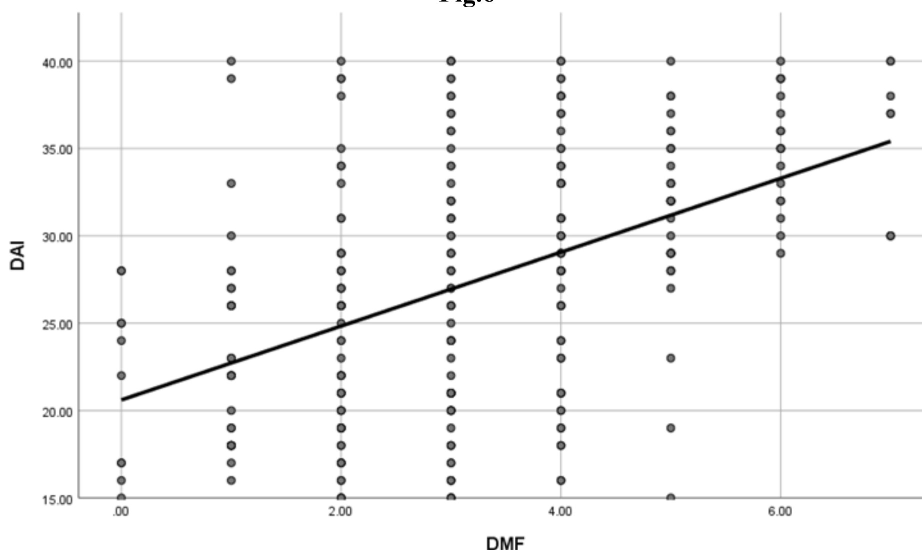


Table no.6 - Correlation of DAI, OHIS, D, M, F and DMF scores of Government School Children

Correlations		DAI	OHI-S	D	M	F	DMF
Pearson Correlation	DAI	1.000	.146	.056	.009	.030	.058
	OHI-S	.146	1.000	.087	-.005	.071	.089
	D	.056	.087	1.000	-.006	.059	.793
	M	.009	-.005	-.006	1.000	-.026	.504
	F	.030	.071	.059	-.026	1.000	.368

	DMF	.058	.089	.793	.504	.368	1.000
P value	DAI	.	.045	.258	.459	.366	.251
	OHI-S	.045	.	.156	.476	.207	.152
	D	.258	.156	.	.470	.248	.000
	M	.459	.476	.470	.	.381	.000
	F	.366	.207	.248	.381	.	.000
	DMF	.251	.152	.000	.000	.000	.

DAI showed a very weak positive correlation with Oral Hygiene Index Simplified (OHI-S) (r = 0.146, p = 0.045), which was statistically significant but of low strength, indicating that poorer oral hygiene had only a minimal association with malocclusion severity in this group.

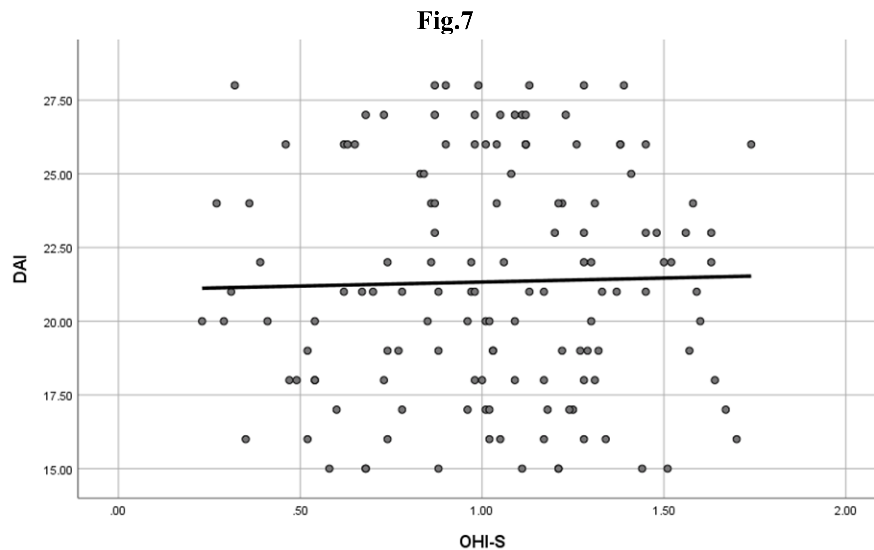
The correlations of DAI with individual caries components were weak and statistically non-significant, including:
- Decayed teeth (D): r = 0.056, p = 0.258
- Missing teeth (M): r = 0.009, p = 0.459
- Filled teeth (F): r = 0.030, p = 0.366

Similarly, DAI showed a weak and non-significant correlation with overall DMFT Index (DMF) score (r = 0.058, p = 0.251). These findings suggest that caries experience had no meaningful association with malocclusion severity in this population. (Table no.6)

Table no. 7 - Multiple Linear Regression analysis for DAI,DMF,OHIS scores of Government school children

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df1	df2	Sig. F Change
1	.153[a]	.023	-.006	3.88247	.023	.787	4	131	.535
a. Predictors: (Constant), DMF, OHI-S, F, M									

Fig.7



The regression model demonstrated a very weak overall correlation (R = 0.153) and a low coefficient of determination ($R^2 = 0.023$), indicating that only 2.3% of the variation in DAI scores could be explained by the included predictors. The adjusted R^2 value was negative (–0.006).

The findings indicate that malocclusion severity (DAI) is largely independent of oral hygiene status and dental caries experience among government school children. Although a statistically significant correlation was observed between DAI and OHI-S, the strength of this association was very weak and clinically insignificant. Furthermore, caries experience (DMF and its components) did not show any meaningful relationship with DAI.

The regression analysis further confirmed that OHI-S and caries-related variables are not significant predictors of malocclusion in this population. (Table no. 7, Fig.7)

Table no.8 - Correlation analysis for DAI, DMF, OHIS scores of Private school children

Correlations		DAI	OHI-S	D	M	F	DMF
Pearson Correlation	DAI	1.000	.025	.023	-.042	-.055	-.040
	OHI-S	.025	1.000	-.033	-.069	-.004	-.054

		DAI	OHI-S	D	M	F	DMF
	D	.023	-.033	1.000	-.026	-.134	.578
	M	-.042	-.069	-.026	1.000	.044	.426
	F	-.055	-.004	-.134	.044	1.000	.620
	DMF	-.040	-.054	.578	.426	.620	1.000
Sig. (1-tailed)	DAI	.	.388	.396	.314	.262	.322
	OHI-S	.388	.	.350	.210	.479	.264
	D	.396	.350	.	.383	.059	.000
	M	.314	.210	.383	.	.305	.000
	F	.262	.479	.059	.305	.	.000
	DMF	.322	.264	.000	.000	.000	.

The Pearson correlation analysis showed **no statistically significant association** between Dental Aesthetic Index (DAI) and oral health parameters among private school children.

DAI demonstrated **very weak correlations** with all variables:

- With Oral Hygiene Index Simplified: r = 0.025, p = 0.388
- With Decayed teeth (D): r = 0.023, p = 0.396
- With Missing teeth (M): r = –0.042, p = 0.314
- With Filled teeth (F): r = –0.055, p = 0.262
- With DMFT Index (DMF): r = –0.040, p = 0.322

All correlations were **non-significant (p > 0.05)**, indicating that **malocclusion severity (DAI) is not associated with oral hygiene status or dental caries experience** in private school children. (Table no. 8)

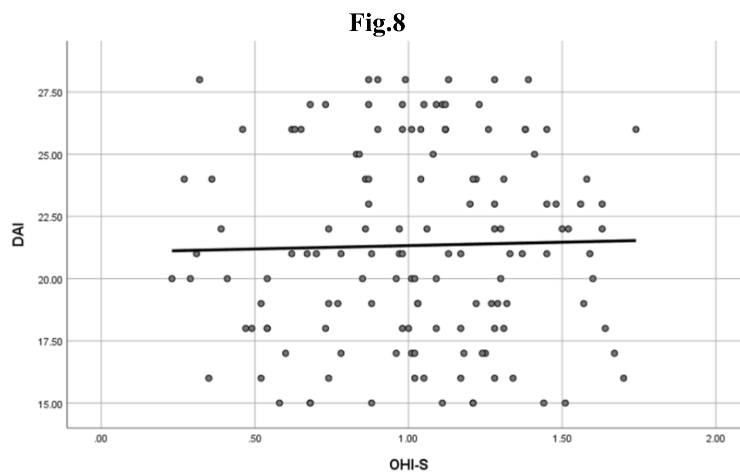
Table no.9 - Multiple Linear Regression analysis for DAI, DMF, OHIS scores of Private school children

Model Summary									
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df1	df2	Sig. F Change
1	.073[a]	.005	-.025	3.96915	.005	.175	4	132	.951
a. Predictors: (Constant), DMF, OHI-S, M, D									

The model showed a **very weak correlation (R = 0.073)** and an extremely low **R^2 value of 0.005**, indicating that only **0.5% of the variation in DAI scores** was explained by the included predictors. The **adjusted R^2 was negative (–0.025)**, The results indicate that **malocclusion severity (DAI) is independent of oral hygiene status and dental caries experience among private school children**. Neither OHI-S nor DMF and its individual components (D, M, F) showed any significant association with DAI.

The regression analysis further confirmed that these variables **do not contribute significantly to predicting malocclusion severity**, explaining only a negligible proportion of variance. (Table no.9)

Fig.8



The regression model was found to be significant in the overall population but not within individual subgroups (government and private school children). This difference may be attributed to increased variability and sample size in the combined dataset, which enhances statistical power and strengthens observed associations. In contrast, subgroup analyses are characterized by restricted data range and reduced sample size, leading to weaker correlations and non-significant regression models. Additionally, intergroup differences in socioeconomic and behavioral factors may have contributed to the observed overall association, which was not evident within homogeneous subgroups. (Table no.9, Fig.8)

IV. Discussion

The present study comparatively evaluated malocclusion, dental caries experience, and oral hygiene status among government and private school children aged 12–15 years. The findings demonstrated significantly poorer oral health status among government school children compared to private school children.

Government school children exhibited significantly higher OHI-S scores, indicating poorer oral hygiene practices. These findings may be attributed to lower socioeconomic background, inadequate oral health awareness, limited access to oral hygiene aids, and reduced utilization of preventive dental services among government school children. Similar observations have been reported in previous epidemiological studies demonstrating the influence of socioeconomic factors on oral hygiene status and oral disease burden.[10]

The present study also demonstrated significantly higher DMFT scores among government school children, with a greater proportion of untreated decayed teeth. In contrast, private school children exhibited higher filled teeth scores, reflecting better access to restorative dental care and improved dental health-seeking behavior. These findings are consistent with previous reports suggesting that socioeconomic disparities significantly influence dental caries prevalence and treatment utilization.[4,10]

Malocclusion severity assessed using the Dental Aesthetic Index was significantly higher among government school children. Poor oral hygiene maintenance, untreated dental caries, premature tooth loss, and lack of early dental intervention may contribute to the development and progression of malocclusion. Previous literature has also reported that unfavorable oral health conditions may adversely influence occlusal development during adolescence.[6,8]

The correlation analysis revealed a strong association between malocclusion severity and oral hygiene status in the combined study population. Increased plaque accumulation and untreated carious lesions may contribute to altered tooth alignment and occlusal discrepancies. Furthermore, untreated dental caries and premature tooth loss can affect arch integrity and space maintenance, thereby increasing the risk of malocclusion development.[3,6]

Interestingly, subgroup analysis within government and private school children separately demonstrated weak and non-significant correlations between DAI and oral health variables. This finding may be explained by the relatively homogeneous characteristics within each subgroup and reduced variability after stratification. The significant association observed in the overall population may therefore reflect broader socioeconomic and behavioral differences between government and private school children.

The findings of the present study highlight the importance of implementing school-based oral health promotion programs, preventive dental services, and early orthodontic screening among school children, particularly in socioeconomically disadvantaged populations. Early identification and management of oral diseases may significantly improve oral health outcomes and reduce the burden of malocclusion and dental caries in adolescents.

Limitations

1. The cross-sectional nature of the study limits the ability to establish causal relationships between malocclusion, dental caries, and oral hygiene status.
2. The study was restricted to selected schools in Pune city; therefore, the findings cannot be generalized to all populations.
3. Behavioral factors such as dietary habits, frequency of tooth brushing, parental education, and socioeconomic status were not assessed in detail.
4. Clinical examination was conducted under field conditions using natural light, which may have influenced diagnostic accuracy to some extent.
5. Radiographic examination was not performed; therefore, hidden carious lesions and certain occlusal anomalies may have remained undetected.

V. Conclusion

The present study revealed poorer oral hygiene status, higher dental caries prevalence, and increased malocclusion severity among government school children compared to private school children. Higher OHI-S, DMFT, and DAI scores observed among government school children indicate a greater burden of oral health problems in this group. A significant association was found between malocclusion severity, oral hygiene status, and dental caries in the overall study population. These findings highlight the importance of implementing school-based oral health education, preventive dental programs, and early orthodontic screening, particularly for socioeconomically disadvantaged children, to improve adolescent oral health outcomes.

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