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Epidemiology of Malocclusion: An Indian Perspective-Review Article

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Abstract	**Review Article**

Millions of individuals worldwide are suffering from orodental problems in spite most of them being preventable. Malocclusion is one of them. In a diverse and vast country like India, there exists a large variation in prevalence of malocclusion. This can be due to variations in ethnicity, nutritional status, religious beliefs, and dietary habits. Various studies have been conducted among Indian regional populations so far. This review gives an overview of the prevalence of malocclusion documented in various epidemiological studies.
Keywords: Malocclusion, Prevalence and Epidemiology studies.

INTRODUCTION

The oral-facial region is usually an area of significant concern for the individual because it draws the most attention from other people in interpersonal interactions and is the primary source of vocal, physical and emotional communication [1]. Adolescent with significant dentofacial discordance suffer from negative self-esteem and social maladjustments [2]. Malocclusion is a developmental condition, not a disease, which is included under the heading of Handicapping Dentofacial Anomaly by World Health Organization and is defined as "An anomaly which causes disfigurement or which impedes function, and requires treatment if the disfigurement or functional defect was likely to be an obstacle to the patient's physical or emotional well-being [3].

Currently malocclusion is third in the ranking of priorities among the problems of dental public health worldwide, surpassed only by dental caries and periodontal diseases [4]. It is the second common dental disorder next to dental caries among children and young adults. About 30-40% children suffer from malaligned teeth affecting proper functioning of dentofacial apparatus and aesthetics [5]. Across the globe the prevalence of malocclusion is considerably high in Europe (nearly 80%) among the Caucasian population and in African countries like Kenya, Nigeria and Tanzania it is ranging from 72 to 86% [6].

India being a large country with its multiracial and multiethnic inhabitants shows a definite variation in the prevalence of malocclusion from north to south region. The prevalence of malocclusion in India has reported wide variation from as low as 19.6% to as high as 96.05% [7] . It is often required to document the prevalence and distribution of oral diseases and understand the dental health practices that people follow as this information is basic for formulation of oral health policies and appropriate programs [8, 9]. This review provides a compilation of regional data to ascertain, highlight and further compare the epidemiological diversity of malocclusion in a huge country like India.

Recording and measuring malocclusion

There is a wide variation in the prevalence of malocclusion by different studies which attributes to different methods employed for recording malocclusion.

The methods of measuring malocclusion are of two types:
- Qualitative methods Devised mainly for epidemiological studies
- Quantitative methods

Qualitative methods [3, 10-12]

Earlier the methods used for recording malocclusion were qualitative ones and were based on descriptive Angle's classification of malocclusion with

or without modifications, which has been widely accepted for measurement.

Quantitative Methods

Few Indices were developed primarily for epidemiological purpose of recording the malocclusion while others were developed in order to grade the severity of malocclusion and to distinguish between malocclusion requiring urgent treatment or a priority of treatment over others. Some prominent epidemiological indices are:

Occlusal Index [11], Dental Aesthetic Index [13-16] ,Treatment Priority Index [6], Handicapping malocclusion assessment [17], Peer Assessment Rating Index [14, 15] (PAR), Index of Complexity, Outcome and Need [18].

Malocclusion in India

The prevalence of malocclusion in India has been observed to be ranging from 20% to 43% [19]. There is a definite racial and geographical variation between the northern and southern parts of India. The prevalence of Class II malocclusion in Delhi and Haryana (NorthIndia) is much higher (10-15%) as compared to Bangalore and Thiruvananthapuram (South India) where it is around 5%. In addition, the southern population has an ethnic affinity for bimaxillary protrusion. Class I malocclusion is the most prevalent malocclusion in India followed by class II and class III [20].

The prevalence and severity of malocclusion is more in urban Indian population than in rural and tribal population and it is more among females than their male counterparts as observed in a study on rural areas of Nalgonda (Andhra Pradesh) [21]. Similar observations were made while studying malocclusion in Tribal children of Mandu (Central India) where most of them had either no or minimal occlusal irregularities. The prevalence of malocclusion in tribal Indian children was found to be very low compared to the urban Indian children [22].

Prevalence of malocclusion in India as reported by various studies:
- 1940-60: Shourie was the first to report prevalence of malocclusion in Punjab as almost 50% [20, 23].
- 1960-70: Shaikh reported the frequency of various types of malocclusion as class I 68.0%, Class II Div 1 as 28.8%, Class II Div 2 as 2.4%, and Class III as 0.8% [24].

Miglani, Tiwari A reported prevalence rate of malocclusion 19.6-37.52% among Punjabi subjects [6]. Jacob *et al.,* found 49.2% of students in Trivandrum had malocclusion [25]. Nagaraja Rao *et al.,* examined 511 school children of both sexes in the age of 5-15 years in Udupi district of South India. Of these 23% children had class I, 4.5% had Class II, and 1.3% had Class III malocclusion [26]. Singh *et al.,* observed the prevalence of malocclusion in rural children in Haryana was 55.3% [7]. Rao DB *et al.,* in a study in Udupi district, Karnataka reported the prevalence of Class I malocclusion to be 23.0%, Class II -4.5% and Class III- 1.3% [27]. Shiva kumar *et al.,* in a study in Davangere reported 80.1% of school children had little or no malocclusion [28].

Table 1: State-Wise Distribution of Malocclusion

Author, Year.	Subjects	Age (in years)	Method Of Recording	Prevalence of Malocclusion
Andhra Pradesh				
Suma, Chandra Shekar, Manjunath (2011) [29]	1794 Male-961 Female- 833	15	Dental Aesthetic Index(DAI)	Definite Malocclusion-9.9% Severe Malocclusion- 3.5% Very severe Malocclusion-3.8%
Muppa et al (2013) [30]	844 Male-555 Female-289	6-30	Angle's Classification	Class I -14.34% Class II -9.95% Class III-5.33%
ChhattisgarH				
Kumar *et al.,* (2012) [31]	883 Male-675 Female-208	7-18	Dental Aesthetic Index (DAI)	Definite malocclusion-2.9% Severe Malocclusion- 2.5% Very severe Malocclusion-1.4%
Chandigarh				
Singh,Utreja, Chawla (1993) [32]	410 Male-161 Female-249	12-30	Angle's Classification	Class I-50.5% Class II division 1- 40% Class II division 2- 5.85% Class III-3.2%

Haryana				
Damle D *et al.,* (2014) [33]	1322 Boys-679 Girls-643	12-15	Dental Aesthetic Index (DAI)	Prevalence- 23.6% Definite malocclusion- 12 year- 16.6%, 15 year- 13.7% Severe Malocclusion- 12 year-5.6%, 15 year- 4.3% Very severe Malocclusion- 12 year- 3.6%, 15 year-3.5%
Delhi				
Kharbanda *et al.,* (1995) [34]	5554 Male-1377 Female-1360	5-13	Dental Aesthetic Index (DAI)	Prevalence of malocclusion- 45.7% Mild- 18.34% Moderate to Severe-27.26% Handicapping Malocclusion-0.1%
Gujarat				
Sanadhya *et al.,* (2014) [35]	957 Male-526 Femlale-421	12–15	Dental Aesthetic Index (DAI)	Overall malocclusion-33.4% Definite malocclusion-24.9% Severe Malocclusion- 6.4% Very severe Malocclusion-2%
Singh *et al.,* (1998) [7]	1019 Boys-688 Girls-331	12-16	Angle's Classification	Prevalence of malocclusion-55.3% Class I-43.6% Class II- 9.8% Class III- 0.6%
Himachal Pradesh				
Bhardwaj, Veeresha, Sharma (2011) [36]	622 Boys-365 Girls-257	16-17	Dental Aesthetic Index (DAI)	Definite Malocclusion-16.39% Severe malocclusion-3.69% Very severe Malocclusion/ handicapping Malocclusion- 0.34%
Pruthi, Sogi, Fotedar (2013) [37]	961 Male-598 Female-363	12-15	Dental Aesthetic Index (DAI)	Definite malocclusion-28.3% Severe Malocclusion- 14.7% Very severe Malocclusion/ handicapping Malocclusion-9.7%
Jammu & Kashmir				
ultan S, Ain TS (2018) [38]	1600 Boys-832 Girls-768	12	WHO criteria of oral health assessment	Prevalence of malocclusion- 78.31% Class I-65.87% Class II- 12.93% Class III- 12.18%
Karnataka				
SureshBahu, Chandu, Shafiulla (2005) [39]	300 Boys-165 Girls-135	13-15	Dental Aesthetic Index (DAI)	Prevalence of malocclusion-38.7% Definite Malocclusion-24.3% Severe malocclusion-10.7% Very severe Malocclusion- 3.7%
Shivakumar *et al.,* (2009) [28]	1000 Male-518 Female-482	12-15	Dental Aesthetic Index (DAI)	15.7% - Definite Malocclusion 3.7% -Severe malocclusion 0.5% -handicapping Malocclusion
Nagarajan, Pushpanjali (2010) [40]	1618	14-15	Dental Aesthetic Index (DAI)	Prevalence of malocclusion-21% Definite malocclusion-14.1% Severe Malocclusion- 4.6% Very severe Malocclusion/ handicapping Malocclusion-2.3%
Singh *et al.,* (2011) [41]	927 Male- 482 Female-455	12	Dental Aesthetic Index (DAI)	13% - Definite Malocclusion 3.2% - Severe malocclusion 1.8% - handicapping Malocclusion

Kerala

Jose,Joseph (2003) [42]	1068 Male-490 Female-578	12-15	Not mentioned	Prevalence of orthodontic problems-20.9% Prevalence among males-54% Prevalence among females-46%

Madhya Pradesh

Jalili *et al.,* (1993) [43]	1085 Boys- 775 Girls-310	6-14	Dental Aesthetic Index (DAI)	Prevalence of malocclusion-14.4% Definite malocclusion-10.5% Severe Malocclusion- 3.7% Very severe Malocclusion/ handicapping Malocclusion-0.2%

Maharashtra

Garcha, Shetiya, Kakodkar (2011) [44]	3500 Male-2330 Female-1170	10-18	Dental Aesthetic Index (DAI)	Definite malocclusion-25.71% Severe Malocclusion- 10.51% Very severe Malocclusion/ handicapping Malocclusion-4.28%
Ahammed *et al.,* (2013) [45]	165 Male-103 Female- 62	12-15	Dental Aesthetic Index (DAI)	Definite malocclusion-10.3% Severe Malocclusion- 5.5% Very severe Malocclusion/ handicapping Malocclusion-0.6%
Gaikwad *et al.,* (2014) [46]	880 Boys-488 Girls – 392	12-15	Dental Aesthetic Index (DAI)	Definite malocclusion-13% Severe Malocclusion- 11.4% Very severe Malocclusion/ handicapping Malocclusion-2.4%
Panhalkar P *et al.,* (2018) [47]	483	10-16	WHO Criteria	Class I- 66.3% Class II-32.7% Class III-1%

Rajasthan

Dhar *et al.,* (2007) [48]	1587 Boys- 827 Girls- 760	5-14	Dental Aesthetic Index (DAI)	Total prevalence- 36.42% No malocclusion- 63.58% Mild to moderate malocclusion-29.74% Severe malocclusion- 6.68%
Trehan, Chugh, Sharma (2009) [49]	700	16-26	Angle's classification	Normal Occlusion- 33.3% Class I malocclusion- 57.9% Class II division 1 malocclusion-5.5% Class II division 2 malocclusion-1.9% Class III malocclusion- 1.4%

Tamil Nadu

Joseph, Dhinahar, Reddy (2011) [50]	613 Boys- 334 Girls- 279	12	Dental Aesthetic Index (DAI)	Definite malocclusion- 25.1% Severe Malocclusion- 12.1% Very severe Malocclusion/ handicapping Malocclusion-6.2%
Reddy *et al.,* (2011) [51]	300 Boys- 161 Girls- 139	12-15	Dental Aesthetic Index (DAI)	Overall prevalence- 73.7% Definite malocclusion- 36.7% Severe Malocclusion- 27.7% Very severe Malocclusion/ handicapping Malocclusion-9.3%

CONCLUSION

Developing countries like India are struggling to eradicate many medical and dental diseases. The main reason behind this is inadequate implementation of preventive oral health care programmes which requires a sound base of epidemiological data. Epidemiological studies on occlusion and malocclusion not only help in orthodontic treatment planning and evaluation of dental health services but also offer a

valid research tool for ascertaining the operation of distinct environmental and genetic factors in the aetiology of malocclusion [9]. Therefore, extensive multi centric studies are required to obtain a countrywide representative data.

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