

Evaluation of Prevalence and Severity of Malocclusion in South Travancore Population

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How to cite the article:

Roopesh R, Manoj KM, Sidharthan B, Manjusha KK. Evaluation of prevalence and severity of malocclusion in south Travancore population. J Int Oral Health 2015;7(7):94-97.

Abstract:

Background: Assess prevalence and severity of malocclusion in 12 – 16 year old population of Travancore using IOTN index. Tertiary care setting, with the study being conducted in the Dept of Orthodontics at PMS Dental College & the samples being collected from four different dental health care centres. Study design is descriptive study.

Materials and Methods: 120 pre- treatment study models of patients aged 12-16 yrs were collected, 30 each from four dental health centres spread across the state. These casts were subjected to three stages of screening based on IOTN index to arrive at the prevalence and severity of malocclusion in the targeted group. Kappa statistics and stratified kappa statistics.

Results: Results of the study showed that the prevalence of malocclusion and treatment need was 53.3%.

Conclusions: The prevalence of orthodontic treatment need in South Kerala was found to be 53.3%.

Key Words: IOTN, Malocclusion, Prevalence, Travancore population

Introduction

The importance of an aesthetic appearance has shown to be an important element in society's acceptance of an individual.¹ Malocclusion often causes psychosocial problems as it affects the aesthetics of the person, disturbances of oral function, such as speech, mastication and swallowing, increased susceptibility to trauma, gingival and periodontal diseases and finally the general health of the individual. With a greater attention to aesthetics, in recent years, there is a notable increase in orthodontic treatment demand as a consequence of the higher perception rate of malocclusions.²

With the growing demand for orthodontic treatment a variety of clinician - based indices have been developed out of which the most commonly employed malocclusion indices are the dental aesthetic index, index of orthodontic treatment need (IOTN), peer assessment rating and index of complexity, outcome and need.³ IOTN was introduced by Brook and Shaw in 1989⁴ and was found to be valid, reproducible and easy to perform since only identification of the most severe trait and assessment of the aesthetic component is required. Information on the prevalence and distribution of malocclusions and its severity in a specific ethnic group is very much essential for planning an orthodontic treatment,⁵ as it helps in early orthodontic intervention. Since there is only little available epidemiological data on the prevalence of malocclusion in South Travancore population, this study is aimed to assess the prevalence and severity of malocclusion in 12-16 years old children of South Travancore using IOTN index.

Materials and Methods

This descriptive study was done for a time period of 1-year with the samples being collected from the records data base of four dental centers. It was found that child population of age 12-16 years of South Travancore comes to approximately 900,000 and is fairly high sample size. Hence, in order to have a representation, the researcher decided to select a sample based on convenient sampling method by fixing the sample as 120 ($n=120$). It is assumed that a fairly larger sample will automatically reflect the peculiar feature of the population. Hence, it is justified. Patients within the age group of 12-16 years who were in their growth period were included in the study and patients below the age 12 years and above 16 years in whom growth had almost completed and patients with history of previous orthodontic, prosthodontic, and facial surgery treatment were excluded from this study. Study models were made anonymous and numbered equally, each of the four centers consisting of 30 subjects. The order of presentation of study models were randomized using random number tables, before they were seen by the examiner. Four heads of the Department of Orthodontics with more than 15 years experience scored the 120 pre-treatment study models to establish a cut-off point to indicate whether treatment was needed or not. This was taken as the gold standard (GS) to which the rest of the eight orthodontist's ratings were compared. Eight orthodontists then screened the 120 pre-treatment study models using the IOTN. At a second session, approximately 30 days after the first session,

each rater again assigned a score to a random subset of 60 study models, stratified by occlusal severity, to test intra rater reliability. For both sessions, the study models were displayed in numerical order on tables in a large room. The raters were asked to start at staggered points throughout the sample and were instructed to work at their own pace with no time limit. At the beginning of both rater sessions, the following verbal and written instructions were given to the raters:

"You are the orthodontic consultant for a private corporation for which a fund has been established to provide orthodontic treatment for personnel. You are to evaluate these study models of personnel and answer the following question: In your opinion, to what extent does this occlusion needs orthodontic treatment?"

Please circle the corresponding number:

None/minimal Very great

1	2	3	4	5	6	7
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At the end of the second session, each rater was asked to answer the following question:

"On the seven-point scale that you have used throughout this rating session, indicate the score at or above which you feel orthodontic treatment is indicated."

This score was termed the indicated treatment point (ITP) and was recorded for each of the 8 raters. The mean ITP of the GS was compared with the mean score of each dental cast. The dental cast is assigned to "no treatment" category, if the mean ITP of the GS was less than mean ITP of each cast.

Study design

Tertiary care setting, with the study being conducted in the Department of Orthodontics at PMS Dental College and the samples being collected from four different dental health care centers, spread over the targeted area. Study design is descriptive study.

No external funding was utilized for this study and cost entirely borne by the investigators.

Statistical analysis

Data were analyzed using computer software, statistical package for social sciences version 16 and were expressed in its frequency and percentage. The simple kappa statistic was used to assess agreement of the index with the expert panel. Weighted (Fleiss-Cohen) kappa statistics were used to assess both intra- and inter rater reliability.⁶ The kappa statistic is a measure of agreement that has been corrected for chance agreement.⁷ A kappa value of 0 indicates no agreement beyond chance, whereas a kappa value of 1 indicates perfect agreement. A score of 3 was selected as cut off values to

grade "low" (1-3) and "high" (4-7) for all scores (Table 1 and Graph 1).

Inter rater reliability was calculated by comparing all raters on the entire sample of 120 sets of casts during the first session⁸. Intra rater reliability was calculated using kappa, which was the index of agreement after avoiding a chance agreement. Intra rater reliability was based on a comparison of the scores assigned by the raters to the subset of 60 casts at the second session to the scores assigned by the raters to those same casts at the first session.

The "truth" or "GS" was determined by calculating the mean score of 4 raters. If the mean score for each cast was compared to the mean score of 4 raters, and if the cast score was below the mean score, the case was assigned to the "no treatment" category. If the mean rater score for a cast was equal to or greater than the mean score of the raters, the case was assigned to the "treatment" category (Table 2).

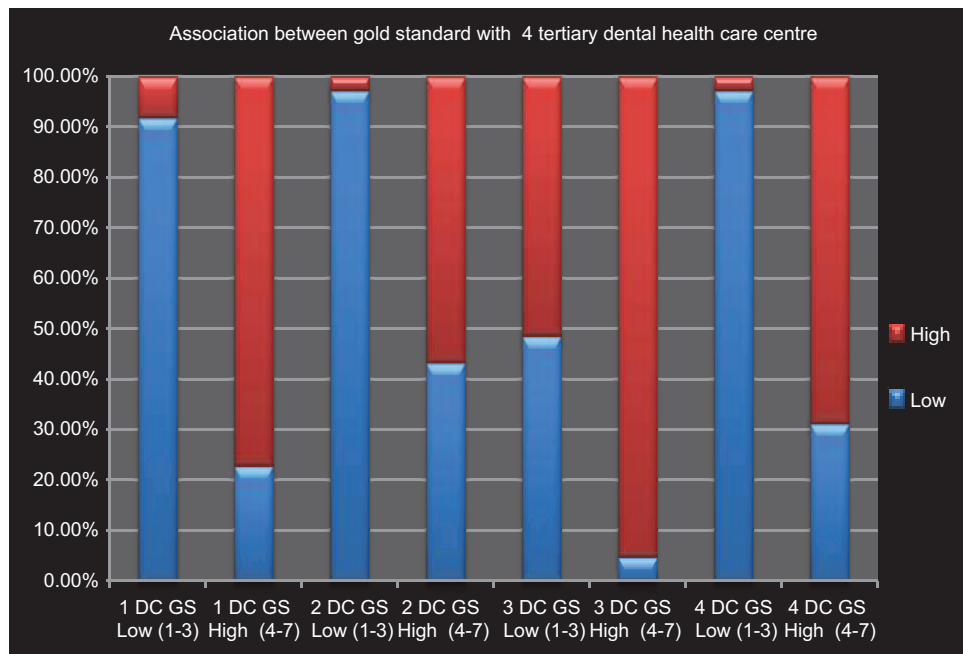
From these comparisons, the following values were calculated for the index⁹: Sensitivity, specificity, positive and negative predictive values, accuracy (percentage agreement), and kappa statistic. Sensitivity is the percentage of all cases needing treatment that the index identified as needing treatment. Specificity is the percentage of all cases not needing treatment that the index identified as not needing treatment. Positive and negative predictive values were the percentage of cases that the index identified as needing (positive) or not needing (negative) treatment that in fact need or do not need treatment. Accuracy in this study was defined as the percentage agreement with the decisions of the expert panel (Table 3). This measure does not take into account agreement due to chance.

Results

The kappa coefficients for the four experts were 0.65, 0.47, 0.41, and 0.6, respectively. The mean ITP score was 3.91 ± 0.89 . The casts with mean scores equal to or >3.91 were classified to the "treatment" category. The remaining casts, with scores <3.91 were assigned to the "no treatment" category. 64 (53.3%) casts belonged to the "treatment" category, while 56 (48.7%) were categorized as "no treatment" category. The 8 raters exhibited a moderate agreement for inter rater reliability. The 8 raters exhibited a very good agreement for inter rater reliability of the 60 casts that were evaluated twice by each rater.

The sensitivity and specificity of the IOTN scores were 71.8% and 73.5%, respectively. The overall agreement between the IOTN GS and 8 orthodontists for assessing orthodontic treatment need (the kappa coefficient) was 0.44. This agreement was moderate according to the Altman classification.¹⁰

The prevalence of orthodontic treatment need in South Travancore was found to be 53.3%. This was more in line



Graph 1: Association between gold standard with four tertiary dental health care centre.

Table 1: Association of GS with four tertiary dental health care centers.

Level	First DC score		Second DC score center		Third DC score center		Fourth DC score center	
	Low (1-3)	High (4-7)	Low (1-3)	High (4-7)	Low (1-3)	High (4-7)	Low (1-3)	High (4-7)
Low (%)	34 (91.90)	19 (22.90)	36 (97.30)	36 (43.40)	18 (48.60)	4 (4.80)	36 (97.30)	26 (31.30)
High (%)	3 (8.10)	64 (77.10)	1 (2.70)	47 (56.60)	19 (51.40)	79 (95.20)	1 (2.70)	57 (68.70)

DC: Dental Centre

Table 2: Association of IOTN GS with heads of the department.

Parameter	Mean (±SD)	IOTN: GS	Mean	±SD	t value	P value
IOTN: First DC (GS)	3.77	Low	2.93	0.78	-9.535	<0.001
	1.19	High	4.50	0.99		
IOTN: Second DC (GS)	3.40	Low	2.95	0.70	-6.351	<0.001
	0.84	High	3.80	0.76		
IOTN: Third DC (GS)	4.96	Low	3.73	1.37	-11.338	<0.001
	1.60	High	6.03	0.82		
IOTN: Fourth DC (GS)	3.51	Low	2.98	0.70	-7.903	<0.001
	0.84	High	3.97	0.67		
IOTN: GS (average)	3.91	Low	3.15	0.64	-14.542	<0.001
	0.89	High	4.57	0.42		

GS: Gold standard, IOTN: Index of orthodontic treatment need, DC: Dental Centre

Table 3: Values calculated for the index

Sensitivity	71.8
Specificity	73.5
False negative	28.2
False positive	26.5
Predictive value of positive test	79.7
Predictive value of negative test	64.3
Positive likelihood ratio	2.7
Negative likelihood ratio	0.4
Accuracy	72.5

with prevalence of orthodontic treatment need of 49.2% in South Travancore population among 12-15 age groups in 1969.¹¹

The kappa coefficient value of 0.44 suggests that there was moderate agreement between the IOTN GS and 8 orthodontists for assessing orthodontic treatment need in Trivandrum population ($P < 0.001$). However, there was good agreement among the IOTN raters for inter rater and intra rater reliability.

Discussion

Malocclusion features have been found to vary with a different population, age, gender, and ethnicity. Assessment of the prevalence of malocclusion gives a scientific insight which helps in disbursing health to the needy. These findings also serve as reference data for the epidemiology of malocclusion.

Specific criteria of random sampling selection were used in this study and the racial composition was a representative of South Travancore. The sample consisted of children of different ages, none of whom had been orthodontically treated. In prevalence studies of malocclusion, the sample should be from a well-defined population, which is large enough, and include children of different ages who are not orthodontically treated. The present sample satisfies the above mentioned requirements very well.

The prevalence of orthodontic treatment need in South Travancore was found to be 53.3%. This was more in line with prevalence of orthodontic treatment need of 49.2% in South Kerala population among 12-15 age groups in 1969. Though malocclusion is not considered life threatening, it has various psychosocial implications since good dental appearance is often associated with success in many pursuits and social acceptance. Children having malocclusion can be identified and corrective measures commenced at the earliest to prevent a wider impact on their psychological development. The epidemiological data on the prevalence of malocclusion is essential in assessing the resources for orthodontic services and can provide valuable information regarding the etiology of malocclusion and other complex traits. The information from this present study can be appropriately utilized for the future planning applicable to orthodontic treatment requirement among this population. As for the need of treatment in different populations and cultures, there are by and large multiple levels of treatment needs based on socio-economic and or ethnic variables. Thus, orthodontic treatment need should be understood as a relative concept and, when expressed as a single figure, is not comparable between different cultures.

Implications for future research

A potential future investigation would be to repeat this study with a few changes in the methodology. Instead of having the raters assign a number that represents the level of treatment for each cast in the sample, the raters could place the casts into one of four possible categories of treatment need. The raters would not have to choose the ITP because the categories define the ITP. This would make the screening procedure less complicated and faster.

Conclusion

The prevalence of orthodontic treatment need in South Travancore population was found to be 53.3%. This denotes that there is not much of difference in the incidence of malocclusion in this population after a period of forty five years since the last published data.

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