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THE PREVALENCE OF ORTHODONTIC TREATMENT NEEDS IN INDIAN POPULATION: A SYSTEMATIC REVIEW

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ABSTRACT

AIM: This systematic review assesses the literature regarding the need for orthodontic treatment in the Indian population between the age group of 7 to 25 years of age.

BACKGROUND: Electronic databases, including PubMed, Google scholar, Cochrane, DOAJ, Lilac and Scopus, were searched from July 2018 to January 2019, with hand searching of selected orthodontic journals undertaken to identify any missed-out records. Selection criteria included Indian population in various states of India with permanent or mixed dentition of age group 7 to 25 years where the Orthodontic treatment need was measured using IOTN and/or DAI. The quality of included studies was assessed with the use of the modified STROBE (Strengthening the Reporting of Observational studies in Epidemiology) approach. Inter-rater agreement of the review authors was used for the inclusion of primary articles, risk of bias assessment, and evaluation of the quality of evidence (modified STORBE).

RESULTS: A total of 654 articles were retrieved in the initial search. After the review process, 30 articles met the inclusion criteria. Sample sizes ranged from 106 to 1800 participants. Based on DAI, 75.90 % of the populations were in no need for treatment and 16.08 % in borderline need for treatment while definite need 5.76 % and severe need 2.24 % of treatment. The aesthetic component of IOTN is in accordance with the results of the DAI, wherein majority of the population (75.94 %) are in no need for treatment and only a minority (27.05 %) require some form of orthodontic treatment. But the results of the dental component of the IOTN state otherwise, wherein 44.15 % of the population needs no treatment while the other 55.83 % of authors have reported that they need treatment.

CONCLUSIONS: There appears to be a considerable proportion of the populations with handicapping malocclusion, where treatment is considered mandatory.

CLINICAL SIGNIFICANCE: by determining the evidence level supporting prevalence of treatment need, the requirement for man power and resource allocation that may be essential for the adolescence of India can be identified and provided. It also helps to identify the awareness amount the population about their dental health care and needs.

KEYWORDS: DAI, IOTN, Indian Population, Orthodontic Treatment Need, Adolescence

INTRODUCTION

Malocclusion is ranked the next most prevalent oral disorder after dental caries in children and young adults. Malocclusion

is not a disease, but can cause functional and aesthetic disparity which might often lead to psychological impairment.[1]Even the apprehension of malocclusion can affect self-esteem, socializing and inter-personal relationship of the individual.[2]Children aged between 11 and 14 years with malocclusion demonstrate significantly more "impacts" i.e. worse quality of life compared with a minimal malocclusion group based on the IOTN.[3]Adolescents who complete orthodontic treatment, report fewer oral health impacts on their daily life activities than those who had never had treatment. Groups of children who need orthodontic treatment exhibit significantly higher impacts on their emotional and social well-being.[4]

Thus, correction of the malocclusion becomes essential and an integral part of oral health care programs.

To aid the assessment of the need for orthodontic treatment various orthodontic indices have been put forth. Of the various indices present[5] the IOTN[6] and the DAI[7] are unanimously acceptable by all and have been used most commonly in descriptive studies.

The IOTN not only takes into consideration the occlusal traits for an individual but also takes into account the aesthetic impairment as this index has 2 components namely, the dental component and the aesthetic component. The Dental Health Component (DHC) represents the biological and anatomic aspect of treatment need and as the name suggests the Aesthetic Component (AC) the aesthetic need.[8]The DAI combines the clinical and aesthetic components to produce a single score, which expresses the severity of malocclusion and the need of orthodontic treatment. The DAI climaxes the importance of physical appeal and by considering societal defined standards for dental appearance, it distinguishes conditions that are potentially handicap psycho‑socially.[9]

In India, the prevalence of malocclusion has been documented as low as 19.6% to a peak of 96.05%,[2] of which the adolescents suffering from malocclusion accounts to about 45 % of the total population. However, the level of malocclusion severity and the need for treatment has not been document clearly.

As the PRISMA statement's PICOS items, the participants included were in the age group of 7 to 25 years with a mixed or permanent dentition who were in various geographical regions of India. There were no interventions assessed and also no comparator group in this review as all the reviewed studies were observational studies. The intent was to assess the level of malocclusion severity and the need for orthodontic treatment. Included study design were the studies which documented the need for orthodontic treatment using IOTN and DAI indices through epidemiological observational studies.

MATERIALS AND METHODS

This systematic review was made in accordance with the Preferred Reporting Items for Systematic Review and Meta-analysis (PRISMA) statement. The review protocol was registered in Prospero international prospective registry of systematic review: CRD42019130926

Inclusion Criteria:

- Indian population in various states of India

- Permanent or mixed dentition

- Age group of 7 to 25 years

- Orthodontic treatment need measured using IOTN and/or DAI

- Cross sectional observational study

Exclusion Criteria:

- Studies including participants with craniofacial abnormalities or syndromes

- Other nationality who reside in India

- Primary dentition

- Population referred for orthodontic treatment from various centres

- Studies which included patients who required re-orthodontic treatment

Search Strategy

During the time period of July 2018 to January 2019, two examiners (M.S and S.B) independently searched for relevant articles with the key words 'orthodontics', 'treatment need', 'Indian population', 'IOTN', 'DAI', 'prevalence of malocclusion', 'epidemiology of malocclusion', 'permanent dentition' and 'cross sectional study' or 'observational study' using internet search engine (PubMed, Google scholar, Cochrane, DOAJ, Lilac and Scopus). In addition, the references of the included articles were searched for further relevant articles. Hand searching of selected journals (American journal of Orthodontics and Dentofacial Orthopaedics, Angle Orthodontist, European Journal of Orthodontics and Australian Journal of orthodontics, Indian Journal of Dental Research) was also undertaken to prevent missing out of articles from the electronic search.

Selection of Studies

After the exclusion of the duplicate articles, screening according to title and abstract were done primarily, and then full text was assessed for eligible studies based on the title and abstract previously chosen. These articles were chosen based on the inclusion and exclusion criteria and were assessed for suitability. For every step, in selection of a study, instances where decision could not be reached for the inclusion of an article by the 2 examiners (M.S &S.B), a third examiner (B.R) was used to determine its inclusion.

Quality Assessment (RoB)

The risk of bias assessment was done using modified STROBE (Strengthening the Reporting of Observational studies in Epidemiology).The check list for the modified STROBE consists of 12 questions which covered various aspects of the methodology in an epidemiological cross-sectional study. If a study attained less than 8 points, it was eliminated from the systematic review.

Data Extraction

The author's name, year of publication, state in India where the study was done, number of males and females and the total sample size, age group and the prevalence of each component of indices of IOTN and DAI were extracted from the studies that were eligible. The dental and aesthetic component of IOTN was divided into no-need, borderline-need and definite-need for treatment. Similarly, the DAI were divided into no-need, borderline-need, definite-need and severe-need for treatment. An electronic spreadsheet was piloted and modified for the tabulation of the extracted data. Efforts were made to contact the authors, when it was suspected that the eligible studies had data from the same sample participants.

      The principal summary was to identify the requirement of orthodontic treatment among Indian population in different states of India as perceived by the orthodontist and the participant himself/herself. The secondary outcome was to

generate a means of generating dental awareness to the population and to put forth the requirement of need for orthodontic treatment across India. Risk of bias across the study was analyzed using modified STORBE and any study which was considered as high risk of bias was eliminated.

RESULTS

Electronic and manual searches of the literature revealed 562 unique citations. After the removal of duplicates and the addition of 12 further articles found by hand searching, title and abstract evaluation resulted in the acquisition of 234 full-text articles. Of these full-text articles, a total of 81 met the prespecified inclusion and exclusion criteria. After evaluation, it was determined that 30 articles fulfilled the requirements for inclusion in this systematic review. The inter-reviewer agreement for the inclusion of primary articles can be considered very good. Fig 1 shows the PRISMA flowchart of the literature selection process.

The included studies were published from 2010 to 2018 with sample size ranging from 106 to 1800 of male and female with a mean age of 14–15 years. All the studies determined the need of orthodontic treatment for an individual using either the Dental Aesthetic Index or the IOTN index.

Based on the DAI, all the studies except the study by Amit Rekhi[10] et al. states that majority of the population are in no need for treatment, while Amit Rekhi et al. states that majority are in borderline need for treatment. The studies conclude that only minimum number of the participants of all the studies is in definite need (5.76 %) or severe need (2.24 %) of treatment while 75.90 % of the populations are in no need for treatment and 16.08% of the populations were in borderline need for treatment.

The aesthetic component of IOTN is in accordance with the results of the DAI, wherein majority of the population (75.94 %) are in no need for treatment and only a minority (27.05 %) require some form of orthodontic treatment.

But the results of the dental component of the IOTN state otherwise, wherein 44.15 % of the population needs no treatment while the other 55.83 % of authors have reported that they need treatment.

DISCUSSIONS

According to the guidelines of the Meta-analysis of Observational Studies in Epidemiology Group, systematic reviews of observational studies often have inherent problems. In addition, epidemiologic studies are highly heterogeneous. They encompass a wide range of methodologies, and subject criteria in primary studies and across studies assessing different populations with high heterogeneity. Studies of this nature have also been shown to be particularly sensitive to publication bias and lack blinding.

Initially, strict selection criteria were considered to decrease the heterogeneity between studies and to allow the inclusion of high-quality studies only. However, the Meta-analysis of Observational Studies in Epidemiology Group advocated using broad criteria and analysis of studies in the light of the confounding factors.[11]Therefore, despite identification of a significant number of potentially relevant studies, because of the increased variation in criteria of the studies and inadequate reporting, a meta-analysis was not possible.

To the best of our knowledge, national wide, population-based studies of the need for orthodontic treatment in India are currently unavailable. Rather than a traditional systematic review of randomized controlled trials, this review is based on observational studies within the general population.

The mismatch of results found in this systematic review between DAI and DHC could be due to the fact that the DH component takes into consideration only the worst or severe occlusal traits while the DAI takes into consideration all the occlusal traits and gives a cumulative result.

When taking into consideration, the cumulative malocclusion's requirement of treatment, it is evident that the participants' perspective of their attractiveness (AC) is different or contradictory in about half of the population to that of the orthodontist's measure of the nominative need for treatment (DC).It could possibly be due to the fact that subjects subconsciously try to allocate themselves on the attractive side.[12] Moreover, perceptive orthodontic treatment needs are influenced by a multitude of varying socio-economic factors, most of which cannot be clearly ascertained.[13,14]

Few subjects could not be scored for AC either by the subjects themselves or by the investigator because their malocclusion could not be matched to any of the photographs as the subjects had anterior open bite and/or had anterior cross bite. These 2 occlusal traits were not included in the AC photographs. This indicated that AC of IOTN was not sensitive enough to account for all types of malocclusion such as class III, open bite, cross bite, crowding in lower arch, increased overjet, missing posterior teeth and impacted canines. Thus, this could also explain the disparity between AC and DHC of IOTN as such occlusal traits could not be visualized on the anterior frontal view photographs of AC which placed them in the "no treatment need" category.[10]

Apart from this, obvious shortcoming of AC photographs, some children had difficulty in giving the AC score especially when their dentition were in transitional stage of partially erupted or missing teeth.

When summarizing the existing epidemiological data in this systematic review, it demonstrated that the need for orthodontic treatment based on the severity of malocclusion in different districts of India has shown an overall fewer demand of orthodontic treatment need for majority of the population whereas only a minority are in definitive need of treatment.

Studies indicate that the sex of the individual play a role in perceiving the need for treatment. Sarabjeet Singh et al.[15] stated that females showed more perception toward the malocclusion on aesthetic grounds as compared to the males, while other studies indicate no statistical significance between the sexes.[16]

CLINICAL SIGNIFICANCE

There appears to be a considerable proportion of the populations (27.05% according to DAI and 55.83% according to DC component of IOTN) with handicapping malocclusion, where treatment is considered mandatory. It could indicate lack of awareness among the school or college going children about the severity of their existing malocclusion. This can be attributed to their weak oral health knowledge as well as parents' neglect toward malocclusion[14] or financial barrier to undergo orthodontic treatment.[17]

LIMITATIONS

Data might not represent the entire population in that city as the sample sizes are not enough. Longitudinal studies are required to estimate the enhancement in quality of life following orthodontic treatment.

These indices take into consideration only a two-dimensional representation of malocclusion, that is, in the frontal view. The sagittal or vertical discrepancies of the malocclusion might not be readily appreciated.

Moreover, the perception of occlusal traits in the buccal segments was generally underestimated by people when compared to those present in the anterior segment Sarabjeet Singh et al[15]. Hence, these indices might not represent the malocclusion in its true sense.

CONCLUSIONS

Orthodontic Index of Treatment need may be used to estimate level of orthodontic treatment need in the community as a whole with which the manpower and resource planning is possible to estimate realistically. The most bothersome finding is that normative and perceived orthodontic treatment requirement did not overlap, since the dental aesthetic index does not allow an assessment of perceived need and does not predict the demand of orthodontic care. Thus, there is a need to include assessment of perceived need in the epidemiological studies to estimate demand for orthodontic treatment in particular regions[16].

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