



Evaluation of the prevalence of malocclusions based on the Index of Orthodontic Treatment Need (IOTN): a review of the literature.

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Abstract

The purpose of orthodontics consists in the correction of malocclusions. It was therefore decided to carry out a review of the literature to assess the prevalence of the different malocclusions especially according to the Index of Orthodontic Treatment Need (IOTN).

The prevalence of malocclusion also depends on the type of dentition. Increased overjet, anterior open-bite and posterior cross-bite are more common in the deciduous dentition as they are related to non-nutritive sucking habits. Due to multiple discrepancies observed among the classifications published on the malocclusal traits, it's necessary a universal classification is needed, in order to compare their prevalence among different studies.

However the Index of Orthodontic Treatment Need (IOTN) represents a valid tool to measure prevalence and treatment need of malocclusion and its use should be encouraged.

Introduction

Malocclusions represent one of the most frequent odontostomatological problems during childhood together with dental caries pathology and the treatment of such anomalies must be aimed at achieving a correct dento-maxillo-facial morphology through an occlusal and muscular rebalancing¹.

Dental malocclusions are represented by an abnormal connection between upper and lower jaw teeth and may occur in the three planes of space (vertical, transverse and sagittal). We are therefore faced with a malocclusion in all those cases where the dental arches, bone structures and masticatory muscles are not in an harmonious connection (aesthetic and/or functional disharmony). The presence of malocclusions may cause a variety of problems:

- functional, such as disorders of phonation, mastication, swallowing or breathing;
- aesthetic, since they can determine the aesthetic alteration of the smile up to facial asymmetries;

- social and emotional because severe malocclusions can cause psychological problems;
- articular (temporomandibular joint disorders);
- dental, because misaligned teeth can lead to an increased risk of tooth decay and periodontal disease if the affected patients are not properly instructed in oral hygiene.

Several studies show that the prevalence of malocclusions in modern society is very high and it is estimated at about 60-80%^{2,3}. However, this figure is very generic;

Indeed, studies conducted to evaluate the prevalence of malocclusions are based on several variables, including:

- classification used (Angle);
- ethnicity;
- IOTN (priority treatment indexes);
- environmental factors;
- kind of dentition.

Initially, epidemiological studies were based on the Angle's occlusal classification method. Angle was the first to establish a criterion for the classification of malocclusions which was based on the connection between the first permanent molars. He made a statistical classification of 1000 subjects who went to his study for a therapy. The lack of randomness in the choice of subjects posed a limit to the reliability of this survey.

In fact, this method is not sufficiently descriptive and specific for orthodontic purposes, and also - through this method - the individual morphological characters can not be sufficiently defined⁴.

The IOTN index (IONT, orthodontic treatment need index, Brook and Shaw) classifies malocclusions based on the meaning of the various occlusion characteristics for future oral health of the subject and also the meaning of the aesthetic characteristics to assess if they are an handicap for the patient⁵.

The intention of the authors was to provide a means in order to identify those individuals who would - most likely - benefit from the therapy. This index evaluates the aesthetic component and oral health, and it defines which occlusion traits can lead to damage in the patient's life. The dental component (DHC,

DentalHealth Component) consists of 5 grades:

- Grade 1, no need for treatment
- Grade 2, slight need for treatment
- Grade 3, borderline
- Grade 4, need for treatment
- Grade 5, extreme need for treatment⁵

In order to know the level of the present case, it is necessary to submit the patient to an orthodontic examination or to have the plaster models of his dental arches.

The parameters to observe are in descending order of severity:

- degree of hypodontia
- overjet
- cross-bites
- displacement of teeth
- overbite⁶

The primary goal of this survey was to detect prevalence of malocclusions needing orthodontic treatment of children and adolescents and the orthodontic treatment need in different populations, according to the Index of Orthodontic Treatment Need (IOTN).

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Methods

Several orthodontic works have been published in international literature about the prevalence of malocclusions especially according to the Index of Orthodontic Treatment Need (IOTN).

The systematic review of literature has been performed on the principal medical databases: PubMed (Medline), Embase and Scopus.

The keywords used were: prevalence, malocclusion, IOTN, orthodontic treatment need.

No restrictions of time and languages have been fixed. The results have been filtered and valued following our eligibility criteria and then organized following the PRISMA method.

The search identified 16,303 abstracts, which were reviewed manually and each article of interest was marked for further review.

The full text of the studies was retrieved and studies that satisfied our eligibility criteria, such as the evaluation of the prevalence of different malocclusal traits according to the Index of Orthodontic Treatment Need (IOTN) were included in this review. At the end only 48 full articles have been selected.

Review

A series of articles contain data about the malocclusions, evaluating the need for treatment using the IOTN index.

The Josefsson's study, which analyzes different ethnic groups (Swedish, Eastern Europe, Asian and African or American) with comparable age and where analyzes have been performed by the same operators in all groups, observes values, in the various grades of the IOTN index, which do not differ much from each other.

The percentage of subjects presenting a grade 1 ranges from 9.9% to 17%, while the most severe malocclusions, of grades 4 and 5, are found in a percentage ranging from 30% to 40%⁷.

In this case the differences are not so extensive and are therefore attributable to the different width of the sample of subjects in the four groups analyzed.

Sharma's and Nobile's studies have assessed the need for orthodontic treatment in relation to age. The first study concludes that the group seeking more treatment is between 12 and 14 years, with a higher percentage of female patients than male⁸.

In Nobile's Italian study, the need for orthodontic treatment was 56.2% at 11, 60.1% at 12-13 years and 56.5% at 14-15 years⁹.

It is noted that the percentage of subjects who need treatment for their malocclusion, i.e. which have grade 4 and 5, ranges between 12.6% and 62%. However, the percentage of subjects who has no need or has a slight need for treatment, which therefore presents a grade 1 or 2, varies from 9.9% to 52%.

It is also noted that three studies^{8, 9, 10} merge data concerning malocclusions of grade 1 and 2, considering them as mild malocclusions that do not require or have a slight need for treatment. The Sharma's study incorporates also the percentages of grades 4 and 5, which are considered severe malocclusions with a strong need for treatment⁸.

In Italy, Miotti (1992) on a sample of 119 children of 12 years old found that subjects classified as grade 1 (19.2%) and grade 2 (39.4%) "mild treatment" were 58.6 %; subjects of grade 3 "moderate need" are 20.9% while grade 4 "serious need" are 15.1% and grade 5 "urgency" are 5.8%. The percentage of subjects with orthodontic treatment at 12 years old is 20.9% considering grade 4 and grade 5¹¹.

In Lunn's study (1993), two different populations are compared: French and English. The survey was

conducted on 148 French children and 111 British 12-year-olds children using the IOTN.

The results obtained with regard to the dental component show that the two populations of grade 1 plus grade 2 of 54% for the French group and 42.3% for the English one; grade 3 of 23% for French, and 24.3% for English; grade 4 plus grade 5 of 23% for French and 33.3% for English¹².

The differences between the two populations were not significant, but it is interesting to note that one third of the French population had orthodontic treatment in progress, 93%, compared to 8% of the English population¹².

The IOTN index can also be useful in evaluating how many subjects have a strong need for orthodontic treatment and have not yet gone to get a cure.

For example, in Nobile's study it has been observed that if you exclude those who already have an orthodontic device (15.9%) at least 43.6% of children have a need for care that has not yet been realized⁹.

Studies using the Brook's and Shaw's index (IOTN) show different percentages of malocclusions in varying grade with very large differences between one study and another. The percentage of subjects with a grade 4 or 5 ranges from 4.2% to 62% while those who do not need treatment vary from 9.9% to 52%.

Given the data regarding the prevalence of the various occlusal traits which exhibit a fairly universal distribution, it is not clear why the percentages on the severity of the malocclusion are so different from each other, especially considering that the IOTN index is standardized and the same throughout the world.

An explanation of these very discordant results may be the different age of the subjects analyzed and the availability of orthodontic care in the various countries; in fact, many studies do not specify whether or not the subjects analyzed have undergone corrective treatment of the malocclusion.

Some studies have estimated the severity of the malocclusion and the consequent need for treatment with different indexes.

In particular, the Suliano's³ study has used the TPI index (Grainger's Treatment Priority Index of 1967) and identified 38.2% of subjects with a minor malocclusion, 20.8% with a defined malocclusion, 13.3% with a severe malocclusion and 9.8% with an extremely severe malocclusion³.

In Shivakumar's and Bhardwaj's studies malocclusion has been established with the DAI (Dental Aesthetic Index) described by the WHO in 1997.

In Shivakumar's KM study, it is observed that 80.1% of subjects have no abnormalities or have a mild malocclusion that does not require treatment (DAI I), 15.7% have a defined malocclusion with a need for treatment (DAI II), 3.7% has a severe malocclusion that requires an elective orthodontic treatment (DAI III) and only 0.5% has a disabling malocclusion with need for orthodontic treatment to be considered mandatory (DAI IV)¹³.

In the Bhardwaj's study it was found that 79.58% do not have a malocclusion or minor malocclusion (DAI I), 16.39% has a defined malocclusion (DAI II), 3.69% a severe malocclusion (DAI III) and 0.34% a disabling malocclusion (DAI IV)¹⁴.

Conclusion(s)

Several studies on orthodontic treatment have already been published which describe the type of malocclusions and their prevalence in different countries on subjects of different ages, reported extremely heterogeneous values.

Nevertheless, the IOTN index turns out to be a good method that makes it possible to directly compare the severity of the malocclusion as it is standardized and univocal.

The limitations of the old indexes to classify malocclusion, such as the TPI (Treatment Priority Index) used in the study of Suliano³ or DAI (Dental Aesthetic Index) used in the studies of Shivakumar¹³ and Bhardwaj¹⁴, is that they were subjective and the evaluation was different based on the operator. The current index (IONT orthodontic therapy need index) is the same for everyone, so that the malocclusion is uniquely classified and that the decision to treat a patient is standardized.

This reduces the subjectivity of the evaluation so that the decision to take on a patient at a public facility is rational. In general, orthodontic treatment is taken for subjects with a grade 4 or 5 of malocclusion. From the analysis of the literature it is seen that unfortunately not all studies use the IOTN index as it would be advisable in order to have univocal decisions and a better comparison of the severity of malocclusion in different countries. Its use, however, should be more widespread.

Efforts to promote assessment of malocclusions and orthodontic treatment need are strongly needed and usefulness of IOTN should be assessed in further research.

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