

Research Report

Treatment results evaluation using the Index of Orthodontic Treatment Need

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ABSTRACT

Background: The use of orthodontic indices were increasingly popular in the last few years. Index of Orthodontic Treatment Need (IOTN) usually was used to assess the needs and demand of orthodontic treatment, eventhough, indices can be used for more than one purpose. **Purpose:** To determine whether the Index of Orthodontic Treatment Need (IOTN) could be able to evaluate the treatment results as well. **Method:** Data was obtained by evaluating each of 202 study models from 17 Orthodontic Postgraduate students. The 'before' and 'after' treatment models were assessed, using the Index of Orthodontic Treatment Need. **Result:** Using the Wilcoxon Signed-Rank test, the assessment of Dental Health Component (DHC) and Aesthetic Component (AC), before and after orthodontic treatment showed significantly differences from each others ($p : 0,000 < \alpha : 0.05$). The Null hypothesis were rejected. The grade of DHC and AC were decreasing to a better score. **Conclusion:** The Index of Orthodontic Treatment Need (IOTN) could be used to assess the orthodontic treatment outcomes, to evaluate before and after orthodontic treatment of the patients. The results of the treatment showed good improvements of dentofacial appearance of the patients which means the successful achievement of the clinical works programs.

Key words: Index of orthodontic treatment need, dental health component, aesthetic component

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INTRODUCTION

The use of orthodontic indices were increasingly popular in the last few years. An index usually used to consider the needs and demands of orthodontic treatment, or to evaluate the severity of malocclusion.¹⁻³ In fact, indices is not only used for screening and measuring the need for treatment, but it may be used for many other purposes. One of the index as an example is the Index of Orthodontic Treatment Need (IOTN), which usually was used to assess the needs and demand of orthodontic treatment. Nevertheless, this index could be used for more than one purpose.^{1,2} The uses of orthodontic indices are: first, screening for handicapping malocclusion, diagnostic classification and describe severity or treatment complexity then, describe and ranking subjects for priority treatment or

measure the treatment need and finally, for epidemiological surveys of malocclusion.³⁻⁵

The Index of Orthodontic Treatment Need (IOTN) was developed by a team in the University of Manchester and has two components which rank malocclusion in terms of the significance of various occlusal traits for the individual's dental health and perceived aesthetic impairment. The IOTN incorporates a Dental Health Component (DHC) and Aesthetic Component (AC). The Dental Health Component was developed by Brook and Shaw⁶ and the Aesthetic Component of the index was developed by Evans and Shaw.⁷ The main aim of this study is to determine whether the Index of Orthodontic Treatment Need (IOTN) could be able to evaluate the treatment results as well. The subsidiary aim is to study whether the output of the clinical orthodontic teaching at the specialist training program is having a successful results.

MATERIAL AND METHOD

To evaluate the orthodontic treatment outcome, the Index of Orthodontic Treatment Need (IOTN) was used in this study. This index aims to rank malocclusion in terms of the significance of various occlusal traits for an individual's dental health and perceived aesthetic impairment, with the intention of identifying those individuals who would be most likely to benefit from orthodontic treatment. The Index incorporates a Dental Health and an Aesthetic Component. The Dental Health Component (DHC) will be considered first, then the Aesthetic Component (AC).

The Dental Health Component was roughly modelled on the Index of the Swedish Dental Board.⁸ The Swedish index was meant as a basic guide, and its practical implementation called for a "good sense of judgement". The DHC was

developed to reduce this subjectivity in measurement, with well defined cut off points. The DHC records the various occlusal traits of malocclusion which would increase the morbidity of the dentition and surrounding structures.⁶ It has five grades, grade 1 represents a small or negligible need for treatment while grade 5 indicates a great need for treatment. In use, various features or traits of malocclusion are recorded. Cleft Palate, severe overjets greater than 9mm would fall into grade 5. Displacements between contact points less than 1mm would fall into grade 1. However, only the highest scoring traits need to be recorded (Table 1).

The grade of DHC describes the priority for treatment, as for example: grade 1–2 means no or little need for treatment; grade 3 means borderline treatment need; while grade 4–5 which usually in this group including severe malocclusion thus it is grade need for treatment.

Table 1. Dental Health Component of IOTN (Treatment need from a dental health perspective)^{1,6}

Dental Health Component of IOTN (Treatment need from a dental health perspective)	
Grade 5 (very great)	a Increased overjet > 9 mm h Extensive hypodontia with restorative implications (more than one tooth missing in any quadrant) requiring pre-restorative or orthodontics i Impeded eruption of teeth (with the exception of third molars) due to crowding, displacement, the presence of supernumerary teeth, retained deciduous teeth and any pathological cause m Reverse overjet greater than 3.5 mm with reported masticatory and speech difficulties p Defects of cleft lip and palate s Submerged deciduous teeth
Grade 4 (great)	a Increased overjet > 6 mm but ≤ 9 mm b Reverse overjet > 3.5 mm with no masticatory or speech difficulties c Anterior or posterior crossbites with > 2 mm discrepancy between retruded contact position and intercuspal position d Severe displacements of teeth > 4 mm e Extreme lateral or anterior open bites > 4 mm f Increased and complete overbite with gingival or palatal trauma h Less extensive hypodontia requiring pre-restorative orthodontics or orthodontic space closure to obviate the need for a prosthesis l Posterior lingual crossbite with no functional occlusal contact in one or both buccal segments m Reverse overjet greater than 1 mm but ≤ 3.5 mm with recorded masticatory and speech difficulties t Partially erupted teeth, tipped and impacted against adjacent teeth. x Supplemental teeth.
Grade 3 (Borderline)	a Increased overjet > 3.5 mm but ≤ 6 mm with incompetent lips. b Reverse overjet greater than 1 mm but ≤ 3.5 mm c Anterior or posterior crossbites with > 1 mm but ≤ 2 mm discrepancy between retruded contact position and intercuspal position. d Displacement of teeth > 2 mm but to ≤ 4 mm. e Lateral or anterior open bite greater than 2 mm but ≤ 4 mm. f Increased and complete overbite without gingival or palatal trauma.
Grade 2 (little)	a Increased overjet > 3.5 mm ≤ 6mm with competent lips. b Reverse overjet > 0 mm but ≤ 1mm c Anterior or posterior crossbite with ≤ 1 mm discrepancy between retruded contact position and intercuspal position. d Displacement of teeth > 1 mm but ≤ 2 mm e Anterior or posterior open bite > 1 mm but ≤ 2mm f Increased overbite ≥ 3.5 mm without gingival contact g Prenormal or postnormal occlusions with no other anomalies. Includes up to half a unit discrepancy
Grade 1 (none)	Extremely minor malocclusions including displacements < 1 mm

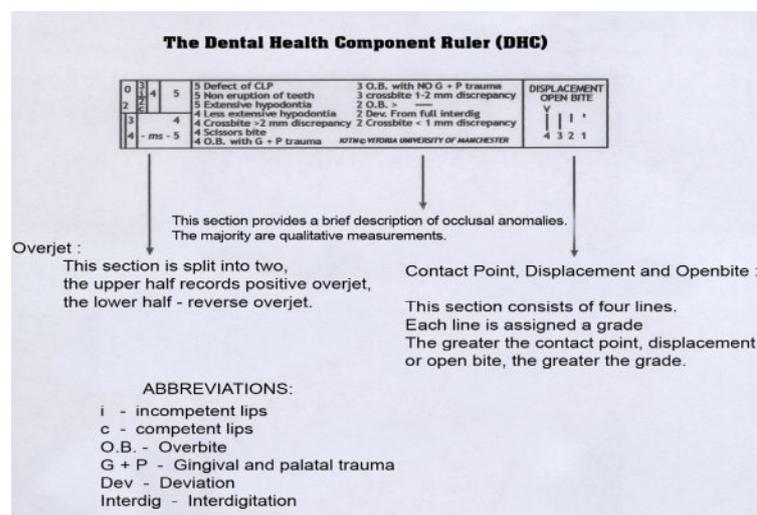


Figure 1. The Dental Health Component ruler.

The Dental Health Component of the IOTN has five categories ranging from 1 (no need for treatment) to 5 (great need) which may be applied clinically or to patients' study casts. The most severe occlusal trait is identified for any particular patient and the patient is then categorised according to this most severe trait. Patients in Grade 5 would include patients with Cleft Lip and Palate, multiple missing teeth or a destructive malocclusion, which would include those with minor tooth displacements where there is little need for treatment.

The Dental Health Component uses a simple ruler (Figure 1 & 2) and an acronym - MOCDO to guide the observer to the single worst feature of the malocclusion.

MOCDO represents Missing teeth; Overjets; Crossbites; Displacement of contact points; Overbites. There are 5 categories, from 1 representing no need for treatment to 5 representing a great need for treatment. Thus a patient who has an impacted upper incisor is immediately categorised as falling into the highest group - IOTN 5 - and no further assessment of the DHC is required. A ruler has been designed containing all the information necessary to record the Dental Health Component. The ruler has been developed for the clinical setting by which information is collected regarding competence of the lips, displacement on closure and masticary or speech problems. Where there are no anomalies of tooth number or position, the ruler will

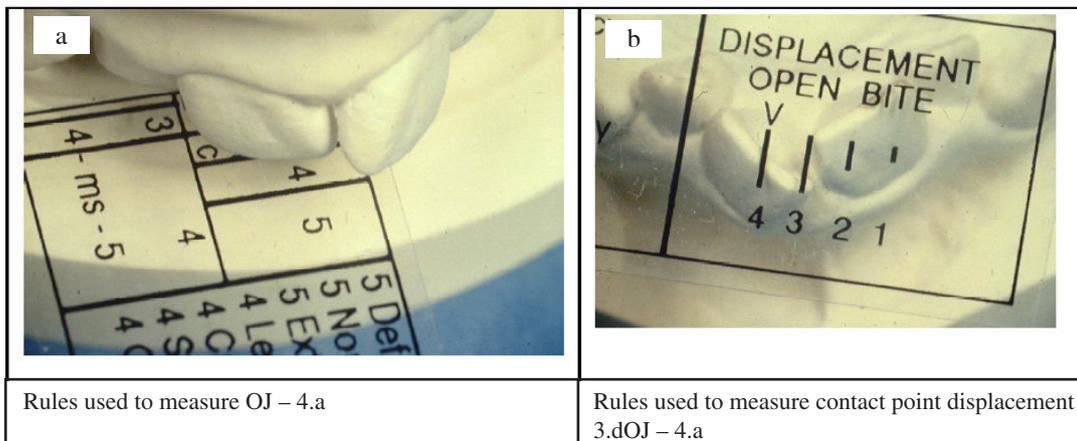


Figure 2. Ruler used to measure the Dental Health Component: (a) Measuring over-jet; (b) Measuring open bite.

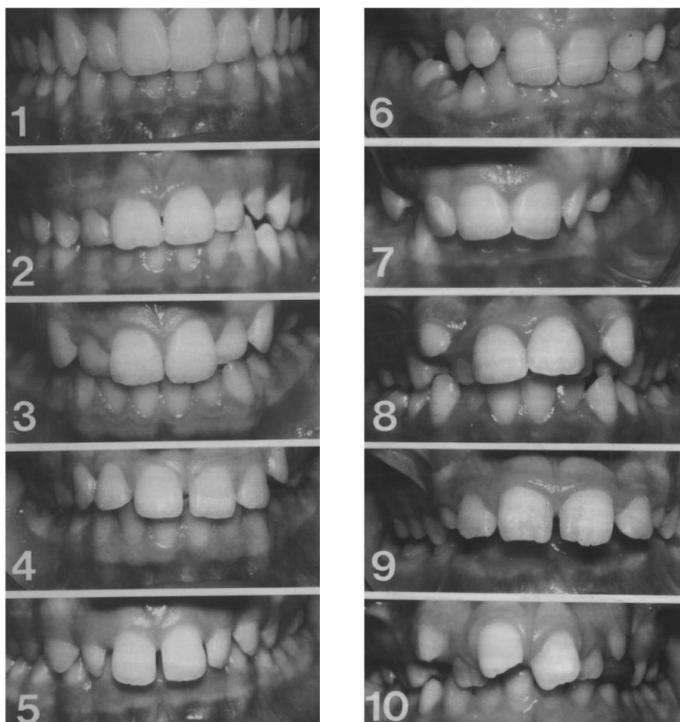


Figure 3. Aesthetic Component Photographs for study model.⁷

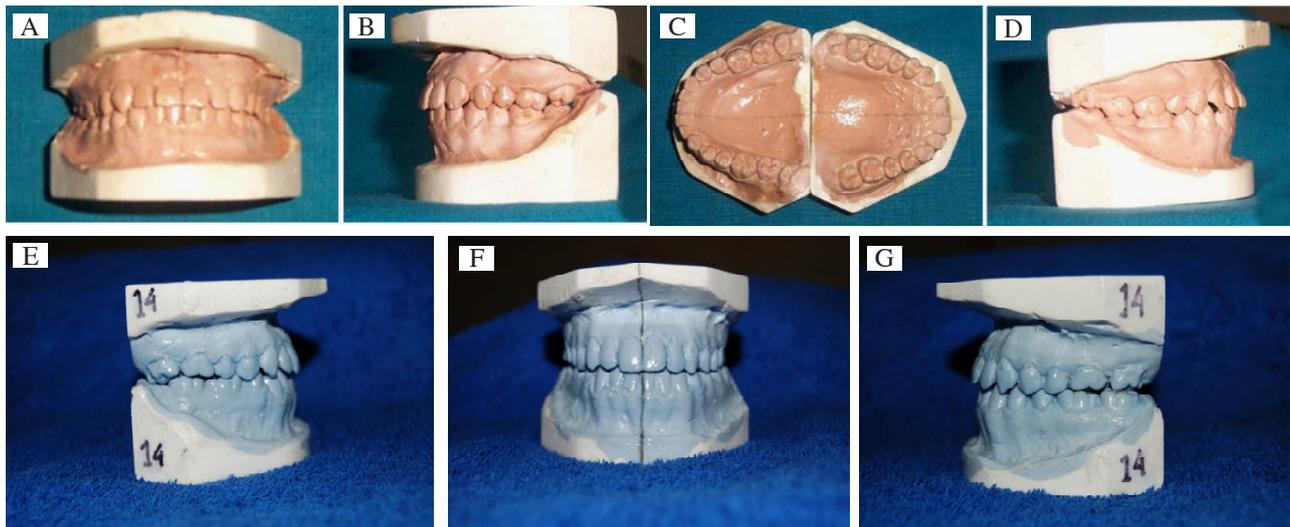


Figure 4. Example of the study model, “before” and “after” treatment. (A–D) Study model before treatment –DHC: 3c : AC : 4, (E–G) Study model after treatment –DHC: 2g : AC : 2

be useful to measure the overjet (positive or negative), to see where this will place the patient. Thus, an increased overjet in the range 6–9mm will be IOTN 4.

There are two ways of recording the DHC. The first is to record the grade only, and in the second the initiating feature would be recorded, for example, an overjet greater than 9 mm. would be graded as 5a (the grade being 5 and the overjet signified by letter a). The second method provides more information regarding the prevalence of the individual occlusal traits. The Aesthetic Component consists of ten scaled colour photographs showing different levels of dental attractiveness (Figure 3).⁷ The dental attractiveness of prospective patients can be rated with reference to this scale. Black and white photographs are used for dental cast assessments. Grade 1 represents the most attractive tooth arrangement with grade 10 the least attractive arrangements of teeth. The score reflects the aesthetic impairment. Monochrome photographs and dental casts have an advantages in that raters are not influenced by oral hygiene, gingival conditions or poor colour matches in restorations affecting anterior teeth.⁹

The grade of AC describes the aesthetic matters and priority for treatment, that is: grade 1–4 means no or slight need for treatment; grade 5–7 means borderline treatment need; while grade 8–10 which usually in this group including severe malocclusion thus it is grade need for treatment.

The Aesthetic Component of the IOTN consists of a ten-point scale illustrated by a series of photographs which were rated for attractiveness by a lay panel and selected as being equidistantly spaced through the range of grades.⁷ A rating is allocated for overall dental attractiveness rather than specific similarities to the photographs. The final value reflects the treatment need on the grounds of aesthetic impairment and by implication the sociopsychological need for orthodontic treatment. Both parents and patients find this

easy to apply and there is a high level of agreement between the scores obtained by dentists, parents and children. There seems to be a general agreement that a DHC of less than 4 and an AC score of below 7 do not justify treatment by a hospital based consultancy except for teaching or research purposes. To use this index for the survey, the examiner had been calibrated in the University Dental Hospital of Manchester, in the United Kingdom with some of others dentist.

The samples for this study included of 202 study models from 17 Orthodontic postgraduate students of the Specialist Orthodontic Program at the Faculty of Dentistry, University of Airlangga who had agreed to be evaluated. The study models taken were the ‘before’ and ‘after’ treatment study casts impression of the patients. The study casts which included in this study, should have good details of ‘before’ and ‘after’ treatment alignment and have no broken tooth in the casting model impressions (Figure 4). The data were collected by using the Index of Orthodontic Treatment Need (IOTN). Firstly the study casts were measured using the Dental Health Component Ruler of the IOTN for the Dental Health Component (DHC) score. The Aesthetic Component (AC) of the IOTN is also measured and scored by reference to 10 scaled standard black and white photographs for study model showing levels of attractiveness, from Grade 1 (most) to Grade 10 (least attractive). The scores are said to reflect the aesthetic impairment and need for treatment. The IOTN assessment took only 1 minutes per pair of study cast. The data were measured and collected at the clinic of orthodontic postgraduate student at the University of Airlangga Dental Faculty. The measurement of the DHC and the AC were recorded and calculated for the statistical test for the results of the calculation of DHC pre- and post- treatment as well as the AC pre-and post treatment to reinforce the hypothesis of this study.

RESULT

It was observed that when the data analysed by statistical calculation using One Sample Kolmogorof-Smirnov Test showed the abnormal distribution as $p : 0.00 < \alpha : 0.05$, then regarding this result, the Statistical non-parametric was used for this study.

The Index of Orthodontic Treatment Need (IOTN) was separated into two components, i.e. the Dental Health Component (DHC) and the Aesthetic Component (AC) to assist evaluation. In fact originally, the Index of Orthodontic Treatment Need was used as an objective measurement of need and demand for orthodontic treatment. The two component of the IOTN usually inter-related to each other. To prove whether this index could be used for other purposes, thus some statistical tests were used for this study.

The Spearman's Ranks correlation between DHC pre- and post- treatment showed non-significant correlation since $r = 0.118$ with $p : 0.096 > \alpha : 0.05$; it means the DHC pre treatment is not correlate to DHC after treatment while when tested the correlation between the two components before treatment, the correlation between DHC and AC before treatment according Spearman's Rank Correlation Test, with $r : 0.684$ and $p : 0.00 (< \alpha : 0.05)$ showed a significance correlation, it means the DHC pre treatment is correlating to AC before treatment. If the DHC have a high score in its assessments, the AC tends to follow the grade of DHC as mentioned by some researchers previously.^{6,7}

The correlation between DHC and AC after treatment according Spearman's Rank Correlation Test, with $r : 0.614$ and $p : 0.00 (< \alpha : 0.05)$ showed a significance correlation, the DHC after orthodontic treatment correlating to AC after treatment, it means if the DHC have a lower score after treatment assessments, thus the AC follows the grade of DHC after treatment consecutively. As seen in the results after treatment for example, the DHC from 3c decreases to DHC 2g while the AC decreases from AC grade 4 to AC score 1 (Figure 4).

The same indicator to prove that the scores for each orthodontic cases, evaluated by using the two components of IOTN could be used as assessment for evaluating the treatment results, the Wilcoxon Signed Rank Test, was performed for the DHC before- and after treatment, the result of this test, with $p : 0.000, (< \alpha : 0.05)$ showed a significance difference between the DHC before- and after-treatment. It means the DHC before treatment have higher scores compared to DHC after treatment assessments.

The same pattern showed similar results as AC before- and after- treatment according the Wilcoxon Signed Rank Test; with $p : 0.000, (< \alpha : 0.05)$ showed a significance difference. The AC before treatment have higher scores compared to AC scores after treatment assessments.

The DHC before- and after- treatment according the Wilcoxon Signed Rank Test, with $p : 0.000, (< \alpha : 0.05)$ showed a significance difference and the Aesthetic Component before- and after-treatment according the

Wilcoxon Signed Rank Test, with $p : 0.000, (< \alpha : 0.05)$ showed a significance difference as well.

DISCUSSION

The examination of each 202 pairs study models using the Index of Orthodontic Treatment Need showed good results, Table 1 showed the abnormal distribution. Thus, a non parametric statistical test was applied for this study.

The collecting of data was done fast, only taken two days of examination for the study models to measure the DHC and AC scores. This is due to the fact that the examiner was familiar to use the Index of Orthodontic Treatment Need. Moreover, the index proved to be simple, efficient, easy to use and to learn. Eventhough, the Index of Orthodontic Treatment Need may not an ideal one, but this index could be considered as good malocclusion index, since it has fulfil some of criteria of goo index as stated by Young and Striffler.³ The examination only takes less than one minute if the malocclusion is not too complicated.

The Spearman's Ranks correlation between DHC pre- and post- treatment showed non-significant correlation since $r = 0.118$ with $p : 0.096 (> \alpha : 0.05)$; means the DHC pre treatment is not correlate to DHC after treatment. On the other hands, the correlation between DHC and AC after treatment according Spearman's Rank Correlation Test, with $r : 0.614$ and $p : 0.00 (< \alpha : 0.05)$ showed a significance correlation. In this case it is obvious if the DHC and AC showed positive correlation because the position of teeth after treatment is almost always in a better or good alignment, then the appearance of the 10 scale photographs which is represent most of anterior teeth would be improved as well. Accordingly, if the DHC is having high score, the AC will followed.

The DHC before and after treatment according the Wilcoxon Signed Rank Test, with $p : 0.000, (< \alpha : 0.05)$ showed a significance difference which means there were improvement of DHC scores after treatment. If the DHC grade improves, for example from DHC 3c to DHC 2g means there is improvement of treatment, the treatment showed a good results. There is also a consistency with the Aesthetic Component. The Aesthetic Component before and after treatment according the Wilcoxon Signed Rank Test, with $p : 0.000, (< \alpha : 0.05)$ showed a significance difference, the AC grade improves, for example from AC 4 to AC 1 means there is improvement of treatment, the treatment showed a good results. The DHC and the AC are always corelate to each other.

All results after treatment having a significant difference, it could be concluded that the treatment results in DHC and AC as well showed a good improvement. The AC grade is decreasing to a smaller scores, since the appearance of the aesthetic improved means the result of treatment is good.

The DHC and AC before treatment according the Wilcoxon Signed Rank Test, with $p : 0.000, (< \alpha : 0.05)$

showed a significance difference. The DHC and AC after treatment according the Wilcoxon Signed Rank Test, with $p : 0.000$, ($< \alpha : 0.05$) showed a significance difference.

The comparison between the DHC and AC before and after treatment showing much different. It means the treatment delivered by the Orthodontics Postgraduate students showed a good improvement of the facial aesthetic of the patients. The output of the clinical orthodontic teaching at the specialist training program showed a good successful training and fulfil the expectation of the patients. All the grades of DHC and AC were decreasing to a better score. The Null hypothesis were rejected. The use of this index, the Index of Orthodontic Treatment Need (IOTN) was very good that it could be able not only to evaluate the treatment, but it has been used used for other purpose such as the main purpose is to measure the treatment need in a population.

It is concluded that the Index of Orthodontic Treatment Need (IOTN) could be used to assess the orthodontic treatment outcomes, to evaluate before and after orthodontic treatment of the patients treated by the students of the Orthodontic Specialist at the Dental School of the University of Airlangga. The results of the treatment showed good improvements of dentofacial appearance of

the patients which means the successful achievement of the clinical works programs.

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