

Full Length Research Paper

Orthodontic treatment outcome in specialized training Center in Khartoum, Sudan

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The aim of this study was to determine the need/outcome of orthodontic treatment in terms of improvement in an orthodontic training center in Khartoum, Sudan. Models of 90 patients were referred and treated at Mageet Orthodontic Training Center, Khartoum, Sudan with malocclusions of different types and severity. Three occlusal indices were used. The Index of Orthodontic Treatment Need (IOTN) dental health component (DHC) showed 71.2% of the cases to have great improvement (grade 4-5), 18.8% moderate (grade 3) and 10% slight (grade 2) and 0% no treatment need (grade 1) while for the esthetic component (EC) 37.7% of the cases showed great improvement (grade 8-10), 45.5 % moderate (grade 5-7) and 16.6 % slight (grade 1-4). The Peer Assessment Rating (PAR) showed 57.5% of the cases with mean percentage reduction greater than 70% (93.4% of the cases shown improvement and 6.6% with no change). The Index of Complexity, Outcome and Need (ICON) showed 14.5% of the cases as not requiring orthodontic treatment and (34.4%) as very difficult to treat. The need for orthodontic treatment in Sudan is similar to the need in European countries, despite the fact that treated cases are more severe as compared to European countries.

Keywords: Occlusal indices; Malocclusion; Orthodontics treatment outcome; Dental esthetics, model analysis.

INTRODUCTION

The desire to improve dentofacial esthetics was the main motivation commonly expressed by orthodontic patients (Shaw, 1981). Previous studies on the perception of malocclusion found that adults were generally more aware of the arrangement of their anterior occlusion than buccal segments. The anterior occlusal traits of major concern among adults were anterior crowding, rotations, and overjet (Helm et al., 1986; Espeland and Stenvik, 1991). Men were generally more satisfied with their dental appearance and less likely to perceive a need for orthodontic treatment to correct their malocclusions than women

(Tuominen et al., 1994). Dissatisfaction with dental appearance and desire for treatment decreased with increasing age (Stenvik et al., 1996). Studies on orthodontic treatment need in adults found that up to 1/3 had a moderate to high need for orthodontic treatment (Stenvik et al., 1996; Salonen et al., 1992).

It has been stated for years that orthodontic treatment improves dental health, oral functions, facial aesthetics and quality of life. Conversely, more attention has been given recently to potential risks of orthodontic treatment: root resorption, enamel decalcification, gingival inflammation, loss of periodontal support, pulp inflammation, allergic reaction, trauma, iatrogenic damage, unsuccessful treatment and relapse (Linklater and Fox, 2002). The benefits and risks of orthodontic treatment should be considered seriously prior to treatment.

Precise diagnosis is needed for that purpose. In the last four decades numerous occlusal indices were suggested in order to improve diagnostic criteria (McGuinness and Stephens, 1994).

Occlusal indices can be classified into five categories: diagnostic indices, epidemiological indices, indices of orthodontic treatment need, indices of orthodontic treatment outcome and indices of orthodontic treatment complexity (Shaw et al., 1995). These indices compare pre and post treatment records to register the outcome of orthodontic care. The methods which are used to describe, assess and classify malocclusion can be divided into qualitative and quantitative. They differ not only by morphological or functional criteria, but also by means of assessment on dental models, clinically or both (Ovsenik, 2007). Literature reveals that three occlusal indices are the most frequently used in orthodontic practice.

The Index of Orthodontic Treatment Need (IOTN), originally named the Index of Orthodontic Treatment Priority, was suggested by Evans and Shaw (Evans and Shaw, 1987; Brook and Shaw, 1989). IOTN is used for epidemiological purpose and to determine individual need for orthodontic treatment (Souames et al., 2006). The Peer Assessment Rating Index (PAR) belongs to group of indices of orthodontic treatment outcome. British Standards Working Party is responsible for the development of PAR (Richmond et al., 1992).

The Index of Complexity, Outcome and Need (ICON) was designed, as suggested by its name, to unite assessments of treatment need, complexity and outcome as described by (Daniels and Richmond, 2000) who developed this index based on results of international study.

The aim of this study is to determine the need and outcome of orthodontic treatment in term of improvement at Mageet Orthodontic Training Center.

MATERIAL AND METHOD

Orthodontic models of ninety patients (68 female, 22 male) aged between 11-33 years old (Mean 19.72), referred to Mageet Orthodontic Training Center (affiliated to the University of Gezira, Wad Madani, Sudan), were used in this study (Table 1). Malocclusions of different types and severity in permanent dentition were chosen (Table 1). Dental models were chosen from a list of patients with complete treatment with the only criteria of complete study models before and after treatment. Patients with incomplete study models were excluded and replaced with the following patient on the list. All pre-treatment and post-treatment orthodontic models were numbered and three occlusal indices IOTN, PAR and ICON scored twice. A specially designed scoring sheet was used to collect the data. Two calibrated examiners (orthodontic residents) performed the orthodontic models assessment. The measurement is repeated one month

after the initial measurements for 30 patients to assure accuracy (the margin of error was 0.05 mm).

The IOTN (DHC) uses a five-point scale where the cut-off points have been defined precisely. The patient is assigned to a particular group on the basis of the trait of malocclusion which is considered to be the most severe (Fig. 1). The assessment is made from study casts and from clinical measurements. A special ruler was developed to make measurements fast and easy.

The second part of the index, the esthetic component (EC), evaluates dental attractiveness on a 10-point scale and each step is illustrated by a clinical photograph. Grades 1-4 indicate no/slight esthetic need for treatment, grades 5-7 moderate/borderline need and grades 8-10 indicate a definite need for treatment. The PAR index includes five components: upper and lower anterior segments; left and right buccal occlusion; overjet; overbite and center line. The contact point displacement in the upper and lower anterior segments is recorded as the shortest distance between contact points of adjacent teeth measured parallel to the occlusal plane (Fig. 2). Deviations are given particular scores. The scores are assigned to deviant occlusal traits, multiplied by different coefficients and summed to produce an overall total.

The difference between pre and post intervention scores represents the outcome of a treatment. An orthodontic treatment can be considered successful if percentage improvement at the end of treatment is greater than 70%. Weightings have been derived for the five components after a validation study carried out by 74 British dentists (Richmond et al., 1992: 125-139; Richmond et al., 1992:180-187).

The Index of Complexity, Outcome and Need (ICON) records dental aesthetics, upper arch crowding/spacing, buccal occlusion in sagittal dimension, crossbite and overbite (Daniels and Richmond, 2002). Scores are assigned to deviant occlusal traits and then multiplied by different coefficients and summed to produce an overall total. The score range for orthodontic treatment complexity, outcome and need is shown in (Table 3).

RESULTS

The mean difference of the IOTN before and after treatment DHC 2.34 and the EC 4.8 (Table 4 and Fig. 3 and 4). The mean difference of the PAR score before and after treatment was about 14.87 (Table 4). The average reduction of PAR score, indicating a considerable improvement (Fig. 5) and ICON 43.86 indicating great improvement (Fig. 6).

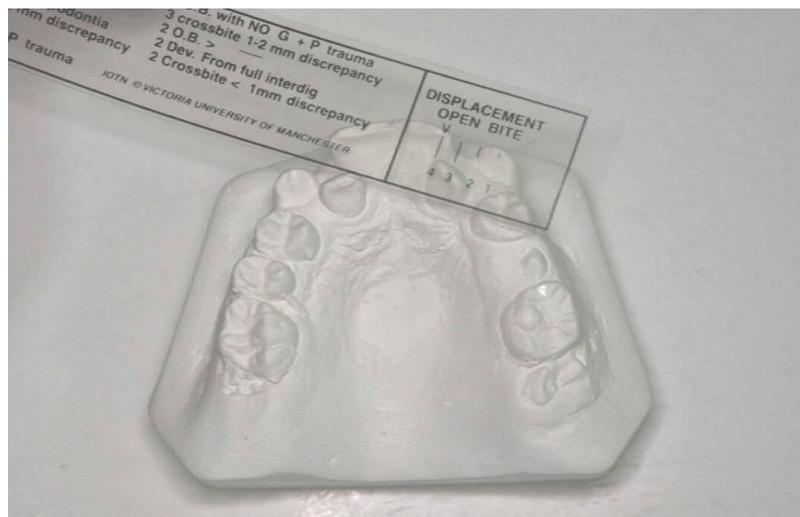
DISCUSSION

Over the years the advantages of IOTN were stated (Richmond, 2005). It is relatively quick and simple to use, systematic and informative. The special advantage

Table 1. Distribution of Gender and Malocclusion in the Sample.

Variables		Frequency	Percentage %
Gender	Male	68	75.6 %
	female	22	24.4 %
Total		90	100 %
Malocclusion	Class I	42	46.7 %
	Class II	39	43.3 %
	Class III	9	10.0 %

Average age 19.72 (6).

Figure 1. The IOTN (DHC) Ruler Measuring the Displacement.**Figure 2.** The PAR measurements of the contact point Displacement.

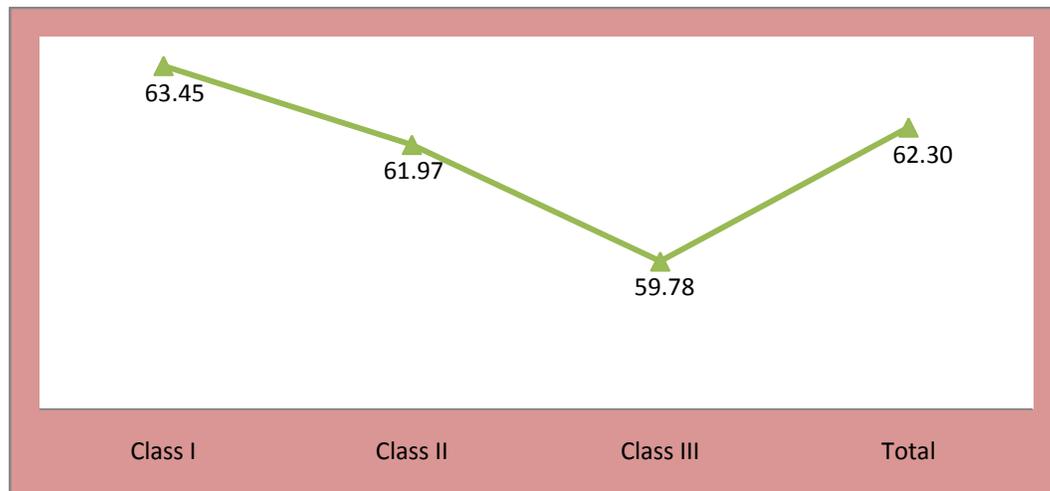
is its ability to adjust to local environment. However, there are certain disadvantages (Richmond, 2005). Some authors believe that it may be too simplistic when

determining orthodontic treatment need. According to the others, the association between deviant occlusal traits and dental health is weak. As orthodontic specialty

Table 3. ICON Scoring Method.

Component	Score						
	0	1	2	3	4	5	Weight
Aesthetic assessment	Score 1 to 10						7
Upper arch Crowding	<2mm	2.1 to 5mm	5.1 to 9mm	9.1 to 13mm	13.1 to 17mm	>17mm	5
Upper spacing	<2mm	2.1 to 5mm	5.1 to 9mm	>9mm		Impacted teeth	5
Cross bite	No cross - bite	Cross bite present					5
Incisor open bite	Edge to edge	<1mm	1.1 to 2mm	2.1 to 4mm	>4mm		4
Incisor overbite	<1/3 lower incisor coverage	1/3 to 2/3 coverage	2/3 up to fully covered	Fully covered			4
Buccal segment Antero-posterior	Cusp to embrasure only class I, II or III	Any cusp relation up to but not including cusp to cusp	Cusp to cusp				3

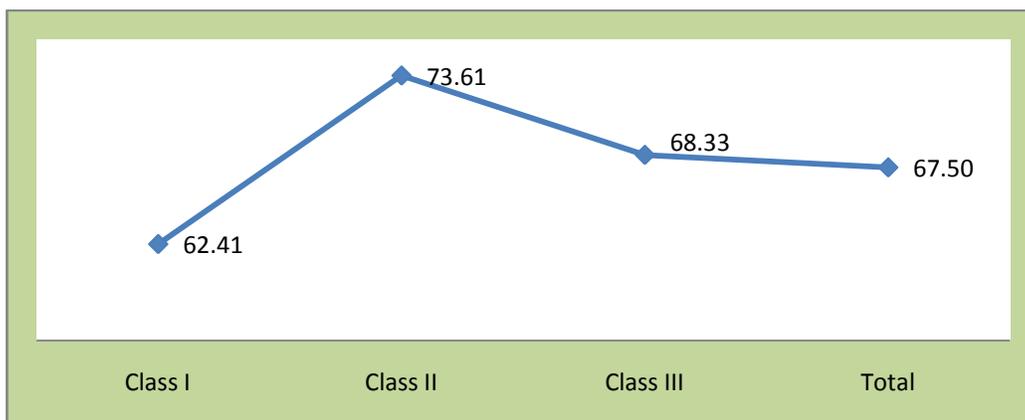
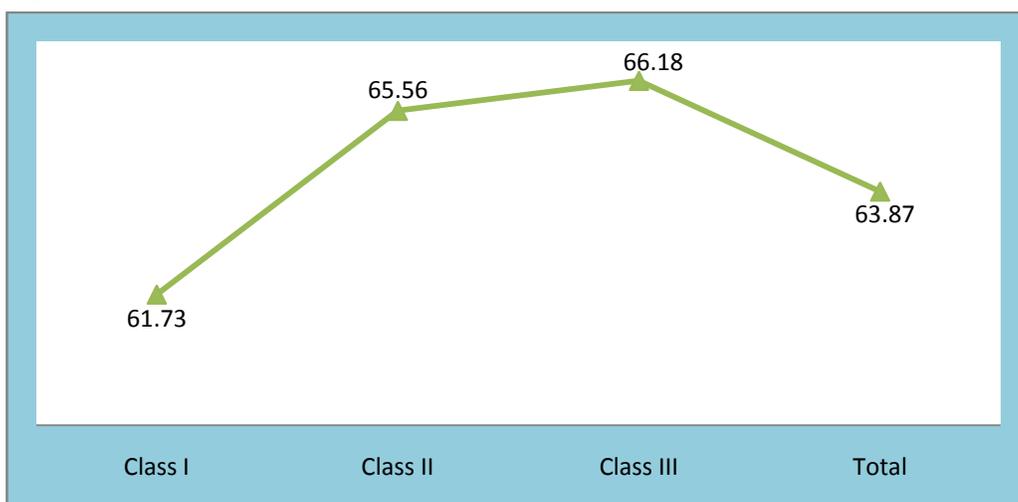
Figure 3. IOTN (DHC) Improvement.



advances a need to monitor treatment standard emerged. This cannot be accomplished using IOTN. Also, it is not possible to predict how complex the treatment would be. IOTN does not answer all the questions relevant to comprehensive orthodontic procedure, in which treatment need, assessment of complexity and outcome are present.

The majority of DHC of patients in this present study belonged to the “treatment need” group 71,2%. 18,8% showed a borderline need for treatment, 10% little need

for treatment and none was found to be without the need for treatment. Considering IOTN EC, 37.7% of cases showed great improvement (grade 8-10), 45.5 % moderate (grade 5-7) and 16.6 % slight improvement (grade 1-4). In reliability assessment, confidence interval, i.e. its range from lower to upper limit, is also important. The wider the interval, the lower the confidence. The reliability of the index is acceptable if the lower limit is greater than 0.60 (Richmond, 2005). In this present study the confidence interval was (2.15 -2.45)

Figure 4. IOTN (EC) Improvement.**Figure 5.** PAR Improvement.**Figure 6.** ICON Improvement.

for the DHC and (4.342 - 5.258) for the EC (Table 4). The lower limit for the esthetic component is near to the acceptable value. The reliability of IOTN in this study

was high enough. Among different malocclusion traits crucial for the DHC score, increased displacement more than 4mm was most common, followed by increased

Table 4. Pair t-test to compare before and after treatment.

Items	Mean			95% Confidence Interval of the Difference		P-value
	Before	After	Mean difference	Lower	Upper	
IOTN (DHC)	3.70 (0.814)	1.36 (0.70)	2.34 (0.94)	2.15	2.54	0.001
IOTN (EC)	6.64 (2.18)	1.84 (1.80)	4.8 (2.19)	4.342	5.258	0.001
PAR	20.58 (9.23)	5.71 (3.66)	14.87 (8.67)	13.05	16.683	0.001
ICON	66.56 (20.16)	22.7 (10.43)	43.86 (19.76)	39.717	47.994	0.001

overjet (6.1 - 9 mm) then impeded eruption, scissor and crossbite with an almost equal prevalence.

The PAR index is used all around the world for determining the success of different treatment methods (Richmond, 2005). There are certain disadvantages of this index described in the literature (Firestone et al., 2002; Dyken et al., 2001). In assessment of treatment outcome PAR does not take into account: periodontal tissue damage, enamel decalcification, root resorption, occlusal functionality and facial aesthetics. Additionally, it may not be sufficiently critical of residual extraction sites, unacceptable incisor inclination and rotations of teeth. Conversely, it may exhibit high criticism in assessment of cases with limited treatment options. It is stated that PAR informs only about one aspect of orthodontic treatment and has no clear 60%, both categorized as improved even though one case has been treated twice as well as the other. A high standard of treatment may be judged according to the mean percentage reduction in weighted PAR score for an individual practitioner's case load, for example, greater than 70%. For a practitioner to produce high standards and treat those cases who have perhaps a greater need for treatment, the mean percentage reduction for the case load must not only be high (e.g. greater than 70%), but the percentage of cases having been greatly improved. The difference between pre- and post-treatment scores reflects the success or degree of improvement. As the score tends towards zero, the deviation from normal is less. Obviously, a score of zero is not always achievable because of the complexity of the case, but generally a measure of 10 or less indicates an acceptable alignment and occlusion, and 5 or less suggests an almost ideal occlusion. In our study 57.5% of the cases with mean percentage reduction greater than 70% that means they are good standard of treatment, 93.4% from cases are improved and 6.6% have shown no changes which due to the simplicity of those cases.

The ICON is derived from expert opinions of 97 orthodontists from Great Britain, Greece, Italy, Hungary, Germany, Norway, the USA, the Netherlands and Spain (Richmond and Daniels, 1998: 180-185 and 324-328). The international panel of orthodontists gave subjective judgments on 240 initial dental models and 98 pairs of

dental models of treated patients. Five occlusal components were found to be highly predictive of mean orthodontist opinion for malocclusion severity, treatment need, complexity and outcome. ICON is the first index to provide information on different aspects of orthodontic treatment and also the first index based on the international criteria. It proved to be simple to use because it records a small number or deviant occlusal traits and does not demand memorizing their sequence by severity (Richmond and Daniels, 1998). It is hard to assess dental aesthetics in transitory stages of early mixed dentition; therefore it is recommended to use ICON in late mixed and permanent dentition (Fox et al., 2002).

In this present study (14.5%) were judged as not requiring orthodontic treatment, 31 cases (34.4%) were classified as very difficult to treat. 85.5% of the cases exhibited acceptable finishing. Most of the patients in this research had a need for Orthodontic treatment where; 32.2% showed great improvement; 25.5% improved substantially, 27.7% improved moderately, 4.4% improved minimally and 10% shown no improvement or worse (because the patients either not regular to their appointment visits or due to poor oral hygiene which enforce premature removal of the braces).

CONCLUSION

The application of occlusal indices in everyday practice provides easier identification of potential orthodontic patients and their appropriate referral to orthodontic examination and treatment, as well as monitoring and promotion of standards of orthodontic treatment. Occlusal indices are reliable diagnostic methods.

The need for orthodontic treatment in private clinics in Sudan, is similar to the need in most European countries, despite of the fact that the number of cases orthodontically treated is much higher as compared to European countries because orthodontic treatment is recently started to popularize, in addition of higher adult population as they did not had the chance to be treated at a younger age.

RECOMMENDATION

We recommend from all orthodontic department in hospitals and private clinics to study occlusal indices before and after treatment, to determine the need and outcome of orthodontic treatment in term of improvement.

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