Original Research Article

Evaluation of degree of complexity, treatment need and outcome in a cohort- A retrospective study

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ABSTRACT

A well-organized and efficient orthodontic service for any given population requires evaluation of therapeutic orthodontic needs, their difficulty and the outcomes after the treatment. The goal of this study is to determine the need for orthodontic therapy, the complexity of the malocclusion, and the degree of improvement once orthodontic treatment is completed. A randomly selected pre and post treatment study models of 50 patients who completed orthodontic treatment in the department of orthodontics in the year 2018-2020 were involved in this study. 92% of samples had orthodontic treatment need. Out of total, the subjects belonged to easy, moderate and difficult categories were 22%, 30% and 48% respectively. After treatment, 54% were greatly improved, 24% were substantially improved, and 22% were moderately improved. According to ICON, a substantial number of participants had difficult treatment complexity, yet all of them had improved outcomes.

1. Introduction

Evaluation of treatment outcomes in various orthodontic programmes have been made on a regular basis. The reputation and prestige of an orthodontic department can be enhanced by the outcomes. Treatment outcomes in a graduate orthodontic practise may frequently give useful information for raising the program's level and enhancing the clinical services provided.

This kind of evaluation might be qualitative or quantitative. In today's world of evidence-based medicine, however, quantitative methods are preferred for analysing orthodontic treatment outcomes. Orthodontists receive their education in a number of school institutions and at different stages throughout their careers. However, defined objective standards must be employed for a reliable, consistent, accurate, and comparative evaluation of malocclusions and orthodontic treatment outcomes. In answer to this need, occlusal indices were developed.

Occlusal indices are quantitative evaluation tools that use continuous or numbered scales to measure occlusion. Occlusal qualities that are analysed with a certain index are assigned a numerical value, and the severity of those traits is decided by the index type.

Different indexes for malocclusion measurement and need for orthodontic treatment have been used such as the Occlusal Index, the Index of Treatment Priority (ITP), the World Health Organization (WHO) malocclusion index, Index of Dental Aesthetics (IDE), Index of Orthodontic Treatment Need (IOTN), Index of severity of malocclusion, Peer Assessment Rating (PAR) and Index of Complexity, Outcome and Need (ICON). Other indices assess the need for treatment which is not necessarily representative of the

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complexity of malocclusion while the ICON evaluates the need for the treatment, complexity of the condition as well the treatment outcome, therefore it has been used in this study.

Data on orthodontic treatment need and complexity based on the index of complexity, outcome, and need (ICON) would be useful for scheduling orthodontic services, developing subject matter expert training programs, and improving public health.

The purpose of study was to evaluate treatment outcome after fixed ortho therapy, during the year 2018-20.

2. Materials and Methods

Pre- treatment and post – treatment dental casts of 50 patient's age ranged 16-30 years with mean age 17.27± 3.91 years were randomly selected from the record room of the Department.

The inclusion criteria for study sample were:

1. Permanent dentition excluding third molars
2. Normal crown morphology
3. No attrition or fracture that might change the natural mesiodistal or the buccolingual crown diameter,
4. No history of clefts or other craniofacial deformities.

Whole data was collected by single investigator who had undergone for training and calibration exercises. All the pre-treated study models were examined and occlusal traits were scored according to those described in computing the ICON. The index has five components, all of which were recorded and scored

1. Dental aesthetics
2. Maxillary arch crowding/spacing
3. Crossbite
4. Anterior vertical relationship
5. Buccal segment Antero-posterior relationship

The results were classified according to (Table 1) from easy to very difficult, and the treatment is indicated when the score is greater than 43.[1]

Table 1: ICON complexity grade score range

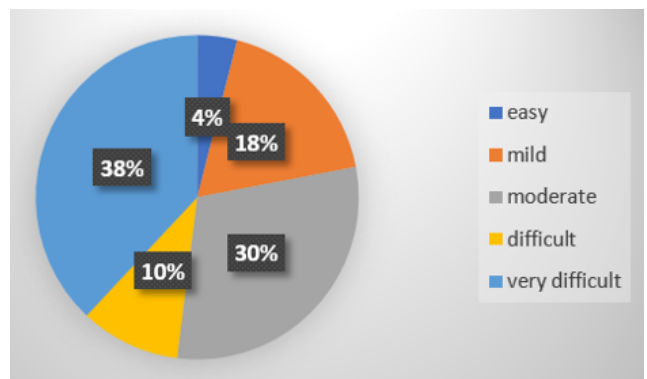| Complexity Grade	Score Range
easy	less than 29
mild	29 to 50
moderate	51 to 63
difficult	64 to 77
very difficult	greater than 77

After counting the pre-treatment and post treatment scores the formula "Improvement grade = Pre-Treatment Score - 4 x Post-Treatment Score" by Dr. Charles Daniels and Stephen Richmond[1] was used to record the grade of improvement in each case, as shown in (Table 2).

3. Statistical Analysis

The data were analysed statistically using the SPSS statistical package (Statistical Package for the Social Sciences Version 23). The qualitative variables were described using frequencies and percentages. The significance level was set at 0.05.

4. Results

1. Orthodontic Treatment Complexity-Out of total, the complexity grades were easy, mild, moderate, difficult and very difficult for 4%, 18%, 30%, 10% and 38% of the sample respectively. (Table 3 and Graph 1).
   As the level of complexity of the malocclusion increased, a corresponding increase in treatment need was seen. Of the patients assessed to have a need for treatment (92%), none of them was found to have malocclusions of easy complexity while students without a treatment need did not have malocclusion that was categorized to be difficult or very difficult to treat.
2. Orthodontic Treatment Need- About ninety two percent (92%) of the studied population had a need for orthodontic treatment, out of which 56% were girls and 36% were boys with a mean ICON score of 68.4 ± 24.5.
3. Orthodontic treatment outcome - Out of the total studied sample, 54% had improved greatly, 24% and 22% were substantially and moderately improved respectively (Table 4). Out of total subjects, 62% were treated by non- extraction and 38% were treated by extraction treatment.
4. Comparison between extraction and non-extraction treatment outcome- The mean ICON score of the subjects who were treated by extraction treatment was reduced from 63.8+/- 26.2 to 16.6+/- 5.9 which was statistically non – significant to the subjects who were treated by non - extraction treatment, whose score was reduced from 71.2+/- 23.4 to 17.5+/- 5.9 (Table 5).

Graph 1: Grades of orthodontic treatment complexity

Table 2: Assessment of orthodontic treatment improvement (Outcome assessment) using ICON index

Improvement Grade	Score Range
Greatly improved	>-1
Substantially improved	-25 to -1
Moderately improved	-53 to -26
Minimally improved	-85 to -54
Not improved or worse	<-85

Table 3: Grades of orthodontic treatment complexity

Complexity	N (count)	% (percentage)
Easy	2	4
Mild	9	18
Moderate	15	30
Difficult	5	10
Very Difficult	19	38

Table 4: Grades of orthodontic treatment outcome

		Treatment		Total(N)	Percentage
		Extraction	Non extraction		
	Greatly improved	8	19	27	54
Outcome	Substantially improved	7	5	12	24
	Moderately improved	4	7	11	22
Total		19 (38%)	31(62%)	50	100

Table 5: Mean ICON score. (Pearson CHI- Square: 2.92^{NS})

	Treatment					
	Extraction		Non- extraction		Total	
	Mean	Standard Deviation	Mean	Standard Deviation	Mean	Standard Deviation
Pre-treatment score	63.8	26.2	71.2	23.4	68.4	24.5
Post treatment score	16.6	5.9	17.5	5.9	17.1	5.9

5. Discussion

Orthodontic index can be described as- A rating or scoring system which assigns a mathematical numeric grade to a patient's occlusion. Several orthodontic indexes have been proposed to find out orthodontic treatment need and to score complexity of patient's malocclusion. The index of orthodontic treatment need (IOTN), PAR and the index of complexity, outcome, and need (ICON) are perhaps the most commonly used orthodontic indexes.

However, there are certain shortcomings of PAR index and the IOTN, namely insignificant correlation between indices, contradictory findings, valid in UK only, undue lenient for end treatment spaces, no scoring for incisor inclination and rotations, and unable to evaluate the difficulty of treatment.

To address the shortcomings of IOTN and the PAR index, the ICON[1] was developed by merging views of 97 orthodontists from different European countries and the USA.ICON has been shown to be a reliable and valid index for assessing orthodontic treatment need.[2,3] The index is intended for use in the late mixed dentition and permanent dentition. Further, the index may be applied clinically to cases and to plaster models without any modification. The ICON is exclusive in incorporating aesthetic score as integral part of the evaluation of treatment need.[4] Orthodontic treatment complexity and need could differ from one population to another depending on various factors which could influence the demand for orthodontic care such as social and cultural conditions, awareness and attitudes to orthodontic care, referral factors and dentist's awareness.[5] Measuring the outcome of orthodontic therapy is an expanding field in orthodontics. The present study assessed the occlusal outcomes in patients treated in our department. Assessment of occlusal treatment results of comprehensive orthodontic therapy performed at higher educational environment will always provide directions to future standards and improvement for postgraduate training.

The mean value of initial ICON score for the present study was 68.4 which indicates difficult level of treatment

complexity similar to Richmond et al.[6] (2001) in which it was 69. The results were not in accordance to mixed dentition sample by King et al.[7] (2010) in which it was 54.9. Pre-treatment score of samples was 68.4 which was above the ICON's cutoff for "treatment need" which means that these cases needed treatment, while the mean of final ICON score was 17.1, compared to Richmond (2001) that was 15.8 and with 33.6 in the mixed dentition sample of King et al. (2010). On contrary to our study, there was another study done by Elfleda et al. (2011) in which the grades of complexity of the population were 21.6% for very difficult and difficult, 7.5% moderate, and 70.9% mild/easy.[8] Orthodontic treatment needs of present study are higher than other studies done in Jordan (28%), Kuwait (28%), United Kingdom (32%), New Zealand (31.3%), Malaysian (47.9%) and Chinese (52%) populations. Contrary to our findings, some African studies, reported much lower estimates for Nigerian (13%) and Tanzanian children (22%).[9–16]

The outcome of orthodontic treatment of the present sample according to ICON shows that 54% "greatly improved", 24% "substantially improved" and 22% "moderately improved" thus verifying that all cases of this sample collectively presented different grades of improvement. Majority of the cases which were greatly improved were treated by non-extraction therapy however the results were non-significant (Pearson Chi-square= 2.92) None of the subjects had reported worsening of treatment. There was a significant difference between the initial and final ICON scores indicating that the occlusion of their patients improved significantly whether they were treated by extraction or non-extraction.

6. Limitation

There can be a mismatch between Dental Health Component and Aesthetic Component grades at times, and they might be contradictory. Ectopic teeth, hypodontia, severe traumatic overbites, and crossbites are examples of occlusal abnormalities that have dental health implications. However, they do not attract Aesthetic Components with a good grade.

7. Conclusion

When measuring and grading complexity and treatment needs, we should rely on the Index of complexity, outcome and need because ICON was effective in evaluation of occlusal and aesthetic component. With such high demand for orthodontic treatment need, it is necessary to give individuals with greatest complexity grade priority for treatment.

Using ICON and improvement grade for the finished case of the orthodontic treated patient gives a clear perception of the end-stage and whether the outcome was accurate

and reasonable. It was concluded that according to ICON 38% of the sample had very difficult treatment complexity, all had improved outcomes (whether they are treated by extraction or non-extraction) out of which around half (54%) were greatly improved.

8. Source of Funding

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9. Conflict of Interest

None.

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