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ORIGINAL ARTICLE

Selection of patients for orthodontic treatment: the effect of the decision-making system employed. A Polish epidemiological study

Dobór pacjentów do leczenia ortodontycznego: wpływ zastosowania danego procesu decyzyjnego. Polskie badanie epidemiologiczne

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Abstract

Background. *The decision as to the necessity of orthodontic treatment is important in the life of all young people but the question arises as to which method of selection is both reliable and scientifically defensible.* ***Materials and methods.*** *The report presents the frequency of orthodontic treatment indication in 993 Polish schoolchildren (average age 11 years 7 months) comparing and contrasting two different methods of selection, namely the Index of Orthodontic Treatment Need (IOTN) both dental health (DHC) and aesthetic components (AC), and an evidence-based evaluation developed for the childrens dental service in Denmark.* ***Results.*** *According to the IOTN (DHC) 22% of the children were allotted to groups 4 and 5 (treatment indicated) with an extra 20.6% in the borderline group 3, whereas the EBE method suggested that 34.7% of children would benefit from orthodontic treatment. Considering the indication for orthodontic treatment on the basis of aesthetics alone, only 2.5% of individuals demonstrated an aesthetic indication necessitating orthodontic treatment. Comparing the effect of the selection method employed on the subjects selected for treatment, some areas of disagreement were identified.* ***Implications.*** *The validity of the methods used for patient selection as well as the weaknesses of "score" or index methods was discussed at length.*

Streszczenie

Wprowadzenie. *Decyzja dotycząca konieczności rozpoczęcia leczenia ortodontycznego jest ważna w życiu każdego młodego człowieka. Pojawia się jednak pytanie: jaką metodą możemy wiarygodnie określić wskazania do leczenia ortodontycznego, które równocześnie będą naukowo uzasadnione.* ***Materiał i metody.*** *Niniejsza publikacja przedstawia częstość występowania wskazań do leczenia ortodontycznego u 993 polskich dzieci w wieku szkolnym (średnia wieku to 11 lat i 7 miesięcy) przy zastosowaniu dwu różnych metod doboru, a mianowicie wskaźnika wskazań do leczenia ortodontycznego (IOTN) z wykorzystaniem zarówno składnika zdrowia uzębienia (DHC), jak i czynnika estetycznego (AC) oraz drugiej metody oceny opartej na faktach naukowych, opracowanej na potrzeby powszechnej opieki stomatologicznej w Danii.* ***Wyniki.*** *Według oceny IOTN (DHC) 22% dzieci zostało zakwalifikowanych do grup 4 i 5 (wskazane leczenie ortodontyczne) z dodatkową grupą graniczną 3 na poziomie 20,6%, podczas gdy wg metody EBE 34,7% dzieci powinno być poddanych leczeniu ortodontycznemu. Biorąc pod uwagę wskazania do leczenia ortodontycznego na podstawie samego wskaźnika estetycznego, tylko 2,5% osób zostało wykazanych do koniecznego leczenia ortodontycznego. Porównując sposób doboru pacjentów do leczenia ortodontycznego, wykazano*

KEYWORDS:
orthodontic treatment, indications, EBE, IOTN

HASŁA INDEKSOWE:
leczenie ortodontyczne, wskazania do leczenia, EBE, IOTN

obszary niezgodności obu zastosowanych metod. W podsumowaniu przedstawiono wiarygodność zastosowanych metod określających wskazania do leczenia ortodontycznego z określeniem słabych stron metod opartych tylko na wartościach punktowych.

Introduction

The decision as to whether the occlusion/malocclusion observed in any patient requires orthodontic intervention is one of the major tasks for any orthodontic therapist. The decision itself is based traditionally of two components (1) *treatment indication* which represents the judgement of the professional examiner based on scientific evidence and (2) *treatment need* defined as the opinion of the patient as to the necessity of treatment. The final decision as to whether the patient should be treated orthodontically or not, usually rests on a combination of these two factors combined with a number of practical factors such as resources, finances, patient attitude to treatment etc. The results of evaluation of the indication need of orthodontic treatment, considered on a population basis, can reveal important information, which can prove useful in connection with:

– the establishment of adequate orthodontic services for the population in question which itself is often related to the establishment of an adequate funding system making attainment of orthodontic treatment a practical possibility for those for whom treatment is felt advisable,
– the organisation of specialist education facilities necessary to create and maintain a service level which can support the services suggested above.

A review of literature concerning the need for orthodontic therapy particularly amongst young patients contains many reports concerning the need for orthodontic treatment among specific populations, both on a European basis[1-10] as well as worldwide,[11,12] and demonstrates some degree of consensus, though often with a large variation, due partly to the methods employed to evaluate orthodontic treatment need including (biological) variation corresponding to the population investigated. Considering Poland, a literature review in 2012[3] reports variation in orthodontic treatment need ranging from 24% to 78%, though the divergence of the materials which form the basis of the studies cited as well as the methods employed would probably explain large differences.

In an attempt to create a system which could offer fairness in the selection of patients for orthodontic therapy many methods have been developed, usually based on the creation of a "score" or "index" system based on deviations observed in the individual occlusion compared with an (often undefined) ideal occlusion. Many such systems have been created[13-19] though it can be stated that the *Index of Orthodontic Treatment Need* (IOTN) developed in 1989 by Brook and Shaw[20] and elaborated in 1994[21] appears to be the system most widely used at present. This index system consists of two separate components, the first of which constitutes a health component (DHC – Dental Health Component) based on and developed from the recomendations of the Swedish Medical Board,[22] which determines the need for orthodontic treatment on dental health grounds evaluated using five occlusal traits: missing teeth, overjet, crossbite, displacement of contact points and overbite. The second section of the IOTN system comprises an aesthetic component (AC – Aesthetic Component) developed by Evans and Shaw[23] which evaluates tooth aesthetics by comparing the appearance of anterior teeth of the individual with ten standard photographs, representing a progressively decreasing succession of stages of dental attractiveness.

While the index (or score) systems evaluate the need for orthodontic therapy on the basis of morphological comparison with the so-called ideal occlusion, the advantages offered to the patient by such a therapy should be considered in the

light of the risk to the patient of the malocclusion observed, as reported in relevant literature.

Considering the reported evidence concerning the indication for orthodontic therapy many aspects including the improvement in masticatory function,[24-26] prophylaxis related to oral hygiene[27,28] (reduced caries risk, improved periodontal status), prevention of root resorption in connection with erupted or ectopic teeth have been considered, though frequently with conflicting opinions. Concerning the aesthetic improvement offered by orthodontic therapy an increase in self-confidence[29] and general attitude to the maintenance of the dentition[30] have both been considered as factors, which could validate the wisdom of orthodontic therapy. The validity of these claims has been challenged in two critical articles by *Helm*[31,32] published in Denmark at a time where a "standardised" occlusal evaluation system was felt necessary in connection with the creation of fair, valid selection criteria in the national municipal children's dental service (Bornetandpleje).

In Denmark an alternative approach was taken. An attempt being made to base the decision as to whether orthodontic treatment should be offered to schoolchildren on evidence gained from the literature, making the selection system basically "evidence based". On the basis of these considerations, a system was created whereby the occlusion is examined in an attempt to identify the presence of particular types of abnormality which, according to the literature, with a reasonable degree of probability could lead to some form of occlusion-related problem at a later date. These complications include:

- damage to a tooth or teeth as a result of abnormal development or placement of tooth buds (ectopia),[33]
- mucosal and tooth damage as a result of occlusal conditions (severe irregularity/ crowding),[34-36]
- functional disorders (including malfunction of the temporo-mandibular joints and myogenic problems),[24]
- tooth/teeth trauma in connection with protrusive incisors and increased overjet,[36,37]
- lack of stability as a result of malfunction of the lips as for example in cases of extreme maxillary overjet,
- psycho-social trauma.[38]

It is noteworthy that this system which we choose to term the *Evidence-Based Evaluation* (EBE) also accepts that the developing occlusion, as evaluated in the child, is undergoing change as a result of growth and considerations relating malocclusion to growth pattern are consequently included. Taking the above-mentioned factors into consideration, the EBE system, which has been adopted by the Danish state (Addendum to Bekendtgørelse om tandpleje. Danish Ministry of Health 2001), orthodontic treatment is felt indicated if at least one of the following symptoms is present:

- non-erupted, misplaced teeth, (where extraction alone is not indicated),
- maxillary overjet, where the incisors are not protected by the lips,
- manifest crowding, especially in the maxillary incisor or canine region,
- deep bite with impingement of the soft tissue or retroclined upper incisors in connection with an unfavourable jaw growth pattern,
- negative overjet or anterior crossbite with either forced bite or bite-locking,
- certain missing teeth where orthodontic treatment can be an alternative to prosthetics,
- serious crossbite or non-occlusion, in connection with forced bite or bite-locking,
- open bite which does not involve extreme growth patterns,
- combination of dentitional problems, which considered separately are less serious, but in combination present an occlusal risk of the types named above.

Based on these criteria it is recommended that every child, usually at the age of 9-10 years should be examined, preferably by an orthodontic specialist and, on the basis or absence or at least one of these malocclusion symptoms, should be allotted to one of the following groups:

- "Orthodontic treatment indicated": one or more of the named symptoms is observed.
- "Orthodontic treatment is not indicated":

none of the named symptoms is identified.
- "Minor discrepancy": signs of malocclusion are observed but do not fulfil the criteria stated for inclusion in "orthodontic treatment indicated".
- "Observation group": the occlusion is not fully formed and the outcome still uncertain.

According to an official footnote to the Danish system, it is not possible to make priorities within the various groups, since the allocation of a group for each individual is based strictly on clinical evidence as revealed by the literature.

It must be underlined that this evaluation does not include patients with cleft lip/palate discrepancy, syndromes involving the head/face, or patients where orthognathic surgery, probably at a later stage, would be indicated. The treatment of such patients is defined and provided for elsewhere in the Danish Health Service regulations.

Aim of study

The aim of the present study was to investigate the frequency of observed indication for orthodontic treatment among a typical Polish child population based on use of two principally different methods: IOTN and EBE, and to compare the effect of employing differing methods when selecting subjects for orthodontic therapy. The investigation should examine and discuss three factors:
- the number of Polish children in a given population demonstrating an occlusion felt to indicate the necessity of orthodontic treatment,
- variation in the need for orthodontic treatment in a child population arising from the choice of method by which subjects are selected,
- comparing and contrasting the various method by which potential patients are selected for orthodontic therapy.

Material and methods

The material on which this report is based was the result of clinical examination in 2012 of 993 schoolchildren (mean age 11y 7m, max 14y 9m, min 9y 3m; 495 ♂ and 498 ♀) by a team of orthodontists in six primary schools in the region of the second biggest city in Poland – Cracow. Each child was examined once by one of two examiners (ANJ and MMJ), who had previously undergone calibration to standardise their evaluation and procedures. Children who had undergone or were undergoing orthodontic treatment were also included in the study.

No radiographs, study casts, or previous written records of the children were available.

For the purpose of the examination a specially devised questionnaire was developed (Figure 1a and 1b) based on the Index of Orthodontic Treatment Need (IOTN): dental health component (DHC) and aesthetic component (AC) and the Evidence-Based Evaluation (EBE) as recommended by the ministry of health in Denmark in connection with orthodontic services for all school children (Addendum to Bekendtgørelse om tandpleje. Danish Ministry of Health 2001).

According to the IOTN (DHC) each patient was allotted to one of five groups, more explicitly the most severe group in which he/she had a corresponding malocclusion trait. Grades 1 and 2 represent "no treatment" or "little need" for treatment respectively, grade 3 a "borderline" need for treatment, and grade 4 and 5 a "great" and "very great" priority for treatment, respectively.[11,12]

The degree of aesthetic component of IOTN (levels 1-10) was chosen by comparison with the model/standard photographs representing three treatment categories: "no treatment need" (grades 1-4), "borderline need" (grades 5-7) and "great treatment need" (grades 8-10).[11,12]

In a second evaluation, using the EBE method, each child was allotted to one of the appropriate groups: "treatment indicated", "minor discrepancy" (indicating that treatment was not deemed absolutely necessary"), "treatment not indicated", or "observation group".

All results were tabulated in Excel® tables and all calculations were subsequently made in Excel®.

Results

IOTN dental health component

The results of the examination of the 993 subjects based on the IOTN dental health component can be seen in Table 1 and Figure 2. It will be noticed that

Patient/ model registration: Date: .....

Examiner: ..... Patient: First name: .....

Orthodontic treatment: …….. Surname: .....

School: …… Date of Birth: …….

Teeth in oral cavity: (+/- = tooth exists/tooth doesn't exist)

UPPER RIGHT								UPPER LEFT							
18	**17**	**16**	**15**	**14**	**13**	**12**	**11**	**21**	**22**	**23**	**24**	**25**	**26**	**27**	**28**
			55	54	53	52	51	61	62	63	64	65			
			85	84	83	82	81	71	72	73	74	75			
48	**47**	**46**	**45**	**44**	**43**	**42**	**41**	**31**	**32**	**33**	**34**	**35**	**36**	**37**	**38**
LOWER RIGHT								LOWER LEFT							

Dental Maturation: DS: ……. M: …… Angle classification:……..

Overjet: ……..….. mm Overbite: …….. mm

Sagittal Molar relationship: Right: ……

Left: ……..

Canine relationship: Right: ……...

Left: ……..

Transverse: Buccal: …… Midline: …….

Crossbite: **CB** Scissor's bite: **SB**

Dentition: Formation: Aplasia: **A** Conical: **C** Supernumerary: **S**

Position: Transposition: **T** Ectopia: **E** Rotation: **R**

Eruption: Non-eruption: **NE** Blocked erupt: **BE** High erupt: **HE**

Space:

	RIGHT				LEFT		**SUM**
U	canine/premol		inc		canine/premol		
L	canine/premol		inc		canine/premol		

Diastema Mediale: ☐ **Generalised spacing:** ☐

Fig. 1a-. *The questionnaire devised especially for the present study.*

Index of Orthodontic Treatment Need

1	2	3	4	5

Esthetic index: ☐

Evidence based method: Observation

Non-erupted, misplaced teeth, where extraction alone is not indicated	
Extreme overjet, where the incisors are not protected by the lips	
Manifest crowding, especially in the maxillary incisor or canine region	
Deep bite with impingement of the soft tissue	
Retroclined upper incisors in connection with unfavourable jaw growth	
Negative overjet or anterior crossbite with either forced bite or bite locking	
Certain missing teeth, where orthodontic treatment can be an alternative to prosthetics 2's ☐ premolar ☐	
Serious crossbite or non-occlusion in connection with forced bite or bite locking	
Open bite which does not involve extreme growth patterns	
Combination of dentitional problems, each less serious, but in combination presenting an occlusal risk of the types named above	

Prospective Surgical Treatment: ☐

Treatment indicated	Treatment not indicated	Minor discrepancy	Observation group

Fig. 1b. *The questionnaire devised especially for the present study.*

Table 1. Estimation of treatment indication of all 993 subjects graduated according to the IOTN Dental Health component, also arranged by gender

IOTN (DHC)	grade 1	grade 2	grade 3	grade 4	grade 5
male (502)	117 (23.3%)	185 (36.9%)	89 (17.7%)	78 (15.5%)	33 (6.6%)
female (491)	93 (18.9%)	174 (35.4%)	116 (23.6%)	74 (15.1%)	34 (6.9%)
Total (993)	210 (21.1%)	359 (36.2%)	205 (20.6%)	152 (15.3%)	67 (6.7%)

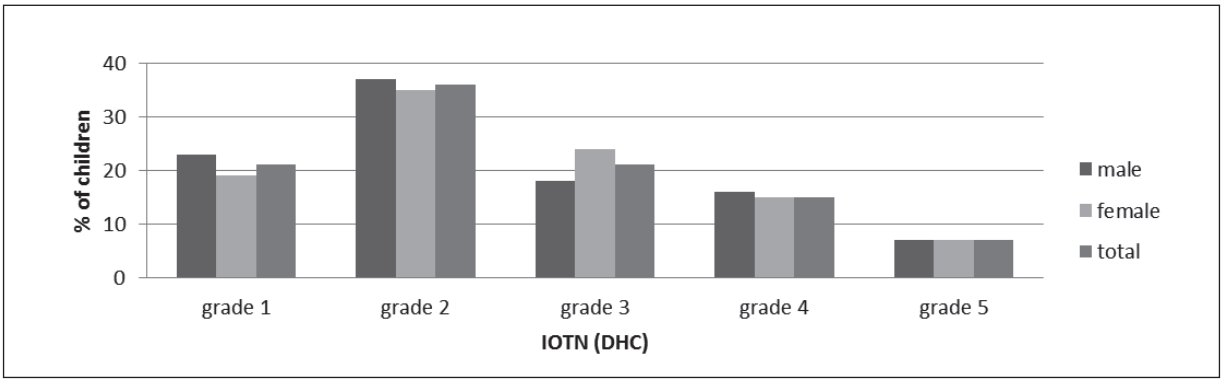

Fig. 2. *Graphic representation of treatment indication of all 993 subjects and according to the Dental Health also arranged by gender.*

the largest single group was grade 2 (359 children, 36.2%) and the number of subjects allotted to grades 3, 4 and 5 was 205 (20.6%), 152 (15.3%) and 67 (6.7%), respectively. Table 1 and Figure 2 also show approximately equal frequency when comparing male and female subjects. 210 subjects (21.1%) were assigned to grade 1. Considering the effects on the "treatment"/"no treatment" decision the findings suggest that 57.3% of the children were assigned to the "no treatment"/"little need" groups (grades 1 and 2), 22.0% to the most severe grades (4 and 5) considered to indicate a need for orthodontic treatment with a further 20.6% allotted to the "borderline" group (grade 3).

IOTN aesthetic component

The aesthetic component of the IOTN evaluation, shown in Table 2 and Figure 3, revealed that 74.6% of the subjects examined could be placed in the "No treatment" groups i.e. groups 1-4 where it is generally considered that treatment is not indicated on aesthetic grounds. Only 2.5% (25) of the subjects examined were allotted to grade 5 where treatment is indicated on the grounds of aesthetics. 228 individuals (23%) were allotted to grades 5, 6 and 7, which are considered borderline as regards treatment indication. Again a close similarity was seen between subjects of different sexes.

Evidence-Based Evaluation

The results of the EBE can be seen in Table 3 and Figure 4 where a close similarity between results based on sex can be seen once again. The EBE system revealed that 34.7% (345) of the child population would benefit from orthodontic treatment whereas 31.3% (311) had no treatment indication, and a group of 23.1% (229) had minor discrepancies which strictly speaking do not require treatment. A small group of 10.9 (108) represented an observation group where the final situation at the end of occlusal development was still uncertain

Comparison of results based on IOTN (DHC) and EBE

A comparison of the results based on EBE and IOTN (DHC) can be seen in Table 4. From the total

Table 2. Estimation of treatment indication of all 993 subjects graduated according to the IOTN Aesthetic component, also arranged by gender

IOTN (AC)	1+2+3+4	5+6+7	8+9+10
male (502)	366 (66.9%)	124 (24.7%)	12 (2.4%)
female (491)	374 (76.2%)	104 (21.2%)	13 (2.6%)
Total (993)	740 (74.6%)	228 (23.0%)	25 (2.5%)

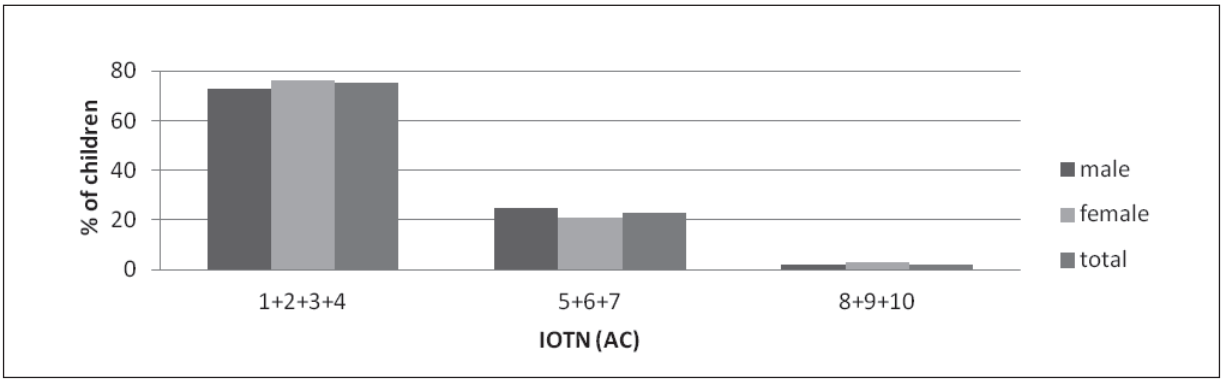

Fig. 3. *Graphic representation of treatment indication of all 993 subjects and according to the Aesthetic component also arranged by gender.*

Table 3. Estimation of treatment indication of all 993 subjects graduated according to the Evidence-Based Evaluation, also arranged by gender

EBE	treatment indicated	treatment not indicated	minor discrepancy	observation group
male (502)	161 (32.1%)	165 (32.9%)	112 (22.3%)	64 (12.7%)
female (491)	184 (37.5%)	146 (29.7%)	117 (23.8%)	44 (9.0%)
Total (993)	345 (34.7%)	311 (31.3%)	229 (23.1%)	108 (10.9%)

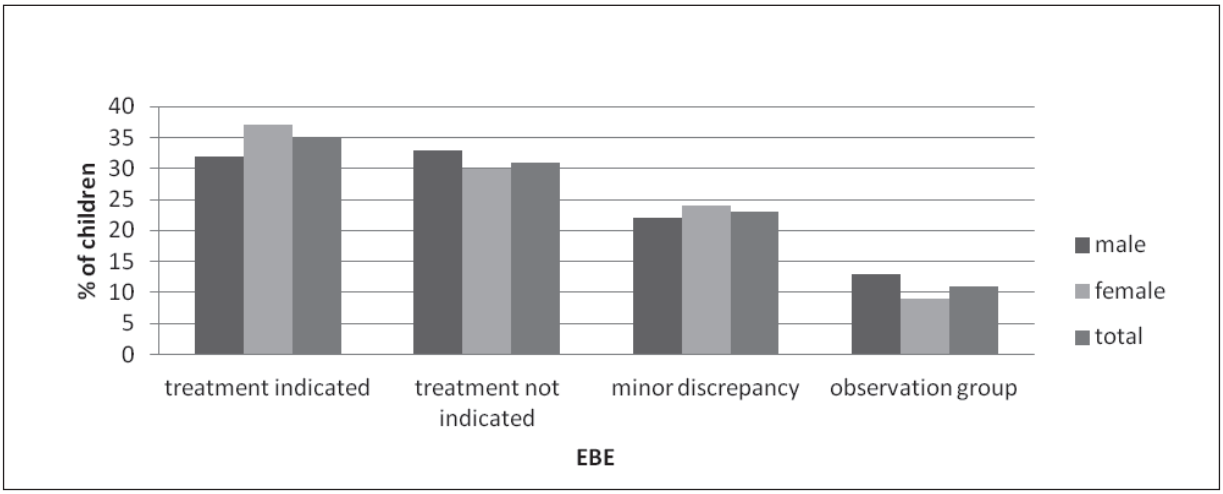

Fig. 4. *Graphic representation of the distribution of all 993 subjects, also divided by gender, appraised by the EBE.*

Table 4. Comparison of results of the IOTN (DHC) estimation and the EBE for all 993 subjects

	IOTN (DHC)					
EBE	grade 1	grade 2	grade 3	grade 4	grade 5	Total
Treatment indicated	4	43	86	146	66	345
Treatment not indicated	155	147	9	0	0	311
Minor discrepancy	22	115	87	4	1	229
Observation group	29	54	23	2	0	108
Total	210	359	205	152	67	993

Table 5. Comparison of results of the IOTN (AC) estimation and the EBE for all 993 subjects

	IOTN (AC)			
EBE	1+2+3+4	5+6+7	8+9+10	Total
Treatment indicated	167	153	25	345
Treatment not indicated	304	7	0	311
Minor discrepancy	191	38	0	229
Observation group	78	30	0	108
Total	740	228	25	993

Table 6. Comparison of results of the IOTN (DHC) estimation and the IOTN (AC) evaluation for all 993 subjects

	IOTN (DHC)					
IOTN (AC)	grade 1	grade 2	grade 3	grade 4	grade 5	Total
1+2+3+4	200	307	133	73	27	740
5+6+7	10	52	67	69	30	228
8+9+10	0	0	5	10	10	25
Total	210	359	205	152	67	993

number of 345 subjects allotted to the "treatment indicated" group only 212 were in the 4 or 5 grade of IOTN (DHC), and a further 86 were allotted to the 3rd grade. Consequently, of the total number chosen for treatment using EBE (34.7% of the total group) 13.4% (133) of these would not be included if the IOTN system was preferred, since they are in grade 1, 2 or 3. Had grade 3 also been included as needing treatment using the IOTN method, a total of 298 subjects (30.1%) would have been offered treatment, again neglecting 4.6% (47) of the total group manifesting malocclusion which would have been deemed to require treatment under the suggestions of the EBE method.

Comparison IOTN (AC) / EBE

As seen in Table 5, in the group of subjects where treatment would be indicated by the EBE method only 25 individuals are seen in the group of "great treatment need" classified by IOTN (AC)

(grades 8, 9 and 10), whereas 167 are in the "no treatment need" (grades 1, 2, 3 and 4) with almost the same number (153) in the "borderline need". No individuals with a high IOTN (AC) score (25 subjects) are omitted from the "treatment indicated" group in the EBE method.

Comparison of IOTN (DHC) and IOTN (AC)

The results of the comparison of the two sections of the IOTN (DHC) and (AC) evaluation can be seen in Table 6 where it can be observed that only limited agreement between the two methods exists. Considering grades 4 and 5 in the DHC, which together consisted of 219 individuals, only 20 of these exhibited an aesthetic component corresponding to grades 8, 9 and 10, whereas, on the other hand, 100 of these demonstrated a very low IOTN (AC) (1, 2, 3 and 4). Considering the individuals with poor aesthetics represented by grades 8, 9 and 10 in the IOTN (AC), 5 individuals were placed in grade 3 of the IOTN (DHC) evaluation defining a borderline indication for orthodontic treatment.

Discussion

The decision as to whether a patient would benefit from orthodontic therapy is something which challenges the orthodontic therapist on a daily basis, the decision usually being made between two parties, the patient and the therapist (with the possible intervention of a third party, usually the parent) or a party involved in the payment of the proposed therapy, which could take the form of an insurance company, as is frequently relevant in Europe. Whichever organisation form is relevant it is important that the decision as to whether treatment is worthwhile and should be initiated be based on usual scientific conditions weighing the advantage of the proposed clinical procedure against the risks involved including damage to the teeth themselves (caries and/or root resorption as well as soft tissue damage in the form of periodontal destruction). Additionally, damage to the function of the stomatognathic system has also been reported. This type of damage is fortunately relatively rare but must be considered carefully in relation to the advantages offered to the patient by the proposed orthodontic therapy. Even though the decision as to whether orthodontic treatment should be recommended is not totally dependent on financial considerations or indeed treatment resources it behoves the therapist to consider the true indication for orthodontic treatment in every case.

Over recent years many reports have attempted to investigate in a scientific manner the correctness of claims that orthodontic therapy resulted in an improvement in oral hygiene (usually in crowding cases) resulting in reduction in caries and/or an improved periodontal status as well as improved masticatory function or correction of malfunction (e.g. forced bite). An improvement in the aesthetic appearance of the teeth and mouth would potentially increase patients' self-confidence[38] as well as motivate them for better dental care.[30] Reviewing the literature concerning these topics and adopting a stringent scientific attitude it must be accepted that relatively little support for these theories can be gained.

Considering the relative lack of scientific evidence of benefit to the individual patient arising from various forms of malocclusion the question still remains as to how patients should be elected for orthodontic therapy or on which basis orthodontic therapy should be recommended.

Generally speaking it appears that one of two approaches can be adopted: (1) an estimation of the degree to which the individual malocclusion differs from what is generally considered to be an "ideal" occlusion, usually by means of some "score" or "grading" system, or (2) an attempt to justify the correction of malocclusion based on reported clinical evidence regarding risk (as reported in the literature). This judgement should be combined with an estimation of the presence or absence of certain occlusal characteristics felt necessary to ensure optimal developmental conditions, as well as establishing good function (as for example incisal contact).

Over the years several types of scoring systems have been developed and the IOTN, the system developed by Brook and Shaw,[20] has won favour in many parts of Europe.[21] The problems connected with this system and in fact all systems involving

scoring were very fairly discussed and criticised in a guest editorial by *Solow*.[39] While the system is relatively easy to perform in practice, the lack of validity as a result of the numerical expression of deviation of morphological characteristics from an ideal picture must be considered a weak point. The IOTN system is basically in two parts, one concerning the dentition and occlusion, and the other in evaluating the aesthetic impression given by malocclusion. In reality, a scoring system is filled with problems since the points awarded for every aspect of malocclusion, for example overjet, crossbite, or aplasia of single teeth cannot be decided on scientific evidence of the risk of malocclusion and must therefore be considered to be the result of chance! How can the importance of one type of malocclusion be compared with another, and does the level of the points awarded really reflect the severity of malocclusion in a true clinical sense? Considering the IOTN system, it is generally considered reasonable to allot subjects to one of five groups where group 4 and 5 are deemed worthy of orthodontic therapy, grade 1 and 2 do not require treatment and group 3 is considered borderline. On what bases have these decisions been made, do they really reflect decisions made *a priori* regarding the detrimental effect of malocclusion on the stomatognathic system.

The evidence-based system adopted by the state authorities in Denmark attempts to avoid the problems described for the scoring or grading systems, and bases the indication for orthodontic therapy on our scientifically investigated experiences regarding the effect of occlusal discrepancies on the development and maintenance of a good, well-functioning occlusion. Admittedly, the system is more complicated since "cut-offs" are not as clearly defined as in the scoring system though factors such as "occlusal function" as well as "growth and development," omitted from the IOTN system are also taken into account, a feature which could be considered very important.

The present study indicates that, on the basis of the EBE, 35% of individuals in a child population would benefit from orthodontic therapy at the same time accepting that 23.1% had a discrepancy which could be defined but which is not considered to pose a threat to the development of the occlusion and good occlusal function. These figures indicate that a significantly higher number of subjects would need orthodontic treatment than it was reported in an earlier epidemiological study performed in Poland some years previously where both the IOTN and EBE were applied.[40]

In the present study based on the IOTN (DHC) approximately 22% of the subjects examined were placed in either grade 4 or 5 indicating the need of treatment, whereas a further 20.6% were placed in grade 3 which was defined as a borderline group. A comparison between the two methods of evaluation revealed that only 66 out of the 345 subjects, where treatment was considered indicated (EBE), were placed in grade 5 illustrating a clear difference in opinion according to the choice of method. Noticeably and perhaps worryingly 47 subjects for whom treatment was felt needed in the EBE were allotted to grades 1 and 2 in the IOTN system, which suggested that treatment was not necessary. The question must be as to whether the use of the EBE resulted in an "over diagnosis" of patients requiring orthodontic therapy or whether they IOTN method "misses" some patients who would really benefit from further investigation.

A further discussion which merits consideration concerns the assumption that patients allotted to grades 4 and 5 in the IOTN groups need orthodontic treatment, whereas patients in grades 1 and 2 do not, and those in grade 3 are on some type of borderline. On which scientific evidence is this based? Perhaps this matter should be given more consideration if the system is to be used. It should also be stressed that the decision of "Yes" or "No" to orthodontic therapy is often made just once in the life of a child, and employing the IOTN scoring system does not take into account the longer term results of growth (patterns) which are known to influence the development of occlusion in the longer term.

Time has also shown that perhaps the EBE should also be reconsidered. An interesting study on the occurrence of tooth wear (attrition) which can, in the long term, jeopardise the dentition has a clear relation to particular types of malocclusion and is related principally to the inclination and vertical relationships of the incisors. Based on

the evidence reported in the study quoted it could be necessary to introduce also this factor into the evidence indicating the wisdom of orthodontic therapy.

The selection of patients for orthodontic therapy, or their exclusion, represents a very important stage in the occlusal development and dental care for the individual. At the same time, the consequences, not least financial, for the parties which should fund this therapy can be considerable. The selection process and not least the scientific evidence on which the decision is based is fundamental if a good combination of fairness and a scientifically defensible system is to be established. It must be realised that malocclusion is basically a biological problem, the decision as to the advisability of orthodontic treatment not lending itself to simple morphometric evaluation if a real valid expression of the advantages of treatment are to be reached.

Conclusion

Results show that the percentage of individuals for whom orthodontics is recommended depends greatly on the selection of the method employed. The present study illustrates the difference in the decision process based on the selection of the method employed. The "Evidence-Based Evaluation" represents a valuable assessment system, being based not only on subjective estimation but on clinical studies and experience.

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