International Journal of Pediatric Otorhinolaryngology 79 (2015) 1063–1066

Contents lists available at ScienceDirect

International Journal of Pediatric Otorhinolaryngology

journal homepage: www.elsevier.com/locate/ijporl

A retrospective analysis of dentofacial deformities and orthognathic surgeries using the index of orthognathic functional treatment need (IOFTN)

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ARTICLE INFO

Article history:
Received 10 March 2015
Received in revised form 13 April 2015
Accepted 17 April 2015
Available online 27 April 2015

Keywords:
IOFTN
IOTN
Dentofacial deformity
Facial skeletal disharmony
Masticatory dysfunction
Orthognathic surgery

ABSTRACT

Objectives: To assess the functional needs of orthognathic cases treated in Northampton General Hospital using the index of orthognathic functional treatment need (IOFTN).
Materials and methods: A retrospective study was conducted on 78 subjects (54 female and 24 males, 10–54 years, mean (SD) age = 21.88 (6.98) years) who had orthognatic surgery in Northampton General Hospital or were in preparation for it (5 case). The sample represents a period between February 1997 and December 2014. The components of IOFTN and Dental Health Component (DHC) of the Index of Orthodontic Treatment Need (IOTN) as well as Malocclusion type were recorded.
Results: Class III malocclusion/skeletal pattern was the most prevalent type (approximately 49%). There were 1, 36, 3, and 38 subjects with Class I, Class II Division I, Class II Division II, and Class III malocclusions, respectively. In terms of sagittal skeletal relationship, there were 2, 37, and 39 subjects with Class I, Class II, and Class III skeletal bases, respectively. The most prevalent IOFTN score in our sample was the 5.2 (29.5%), followed by 5.3 (15.5%), 4.2 (13%), 4.3 (11.5%). Overall, 92.3% were classified as in great and very great functional needs according to the IOFTN. Similarly, 84.6% scored as grade 4 or 5, according to the IOTN (DHC). The bimaxillary type osteotomy was the most prevalent type (61.5%).
Conclusions: Using IOFTN, 92.3% of our sample were classified as having great and very great functional needs. IOFTN is a simple and reliable tool to identify patients in need of orthognathic surgery and can be used in resource allocation for patients with highest functional needs.

1. Introduction

It is estimated that nearly 5% of the UK or USA population present with dentofacial deformities that are not amenable to orthodontic treatment only requiring orthognathic surgery as a part of their definitive treatment [1]. Orthognathic surgery describes several surgical procedures on either or both of the mandible or maxillae to realign the jaws into a more acceptable (normalised) or functional relationship. This often includes a course of orthodontic treatment before and after orthognathic surgery.

In the UK, orthognathic surgeries are funded by NHS England for patients with malocclusions and/or sever dento-facial deformities. The funding should be allocated to patients with the Index of Orthodontic Treatment Need (IOTN) [2] score of 4 or 5 and functional symptoms that have an important impact on patients' quality of life.

With the current drive to reduce costs within the NHS, and in particular, to redirect resources from low priority treatments, to those considered to be high priority and their use is supported by evidence, having an index to objectively identify those treatment/patients seems necessary.

With the help of British Orthodontic Society Consultant Orthodontists Group, the index of orthognathic functional treatment need (IOFTN) has been developed, aiming at prioritizing severe malocclusions not amenable to orthodontic treatment alone and need orthognathic surgery [3]. It has 5 categories, from a Very Great Need (grade 5) through to No Need for treatment (grade 1) (Table 1). Ideally, the funding should be used for patients with grades 4 and 5 of the IOFTN. The index has similarities with the

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http://dx.doi.org/10.1016/j.ijporl.2015.04.027
0165-5876/

IOTN, however, it has modifications to reflect the functional aspects of treatment need for orthognathic patients, such as patients with sleep apnea not amenable to Mandibular Advancement Device (MAD) or Continuous Positive Airway Pressure (CPAP), complete buccal scissors bite with functional implications (both categorised as graded 5 IOFTN) as well as maxillary labial gingival exposure greater than 3 mm (grade 4 IOFTN).

The aim of the present study was to assess, retrospectively, the functional needs of orthognathic cases treated in Northampton General Hospital using the IOFTN; these patients used NHS funding and ideally, they should have been categorised as having great or very great functional needs. Therefore, we also calculated the percentage of patients with IOTFN grades 4s and 5s in our study sample.

2. Materials and methods

A retrospective study was conducted in subjects who had orthognatic surgery in Northampton General Hospital or were in preparation for it (5 cases). This study was initially suggested (ABF) and planned as an audit project. Data collection was done by the first author (CH). Subsequently, acuuracy of the date (IOTN and IOFTN sores, Cephalometric measurements) confirmed by the third author (ABF), who had been calibrated in the use of IOTN as well. The study material for the present study included the relevant records (cephaogram x-rays and study casts), representing a period between February 1997 and December 2014. The Northampton General Hospital ethical committee granted the ethical approval for conducting this study.

2.1. Variables measured and recorded

2.1.1. Skeletal sagittal relationship

The cephalometric variable of ANB angle [*A* point (Subspinale) – Nasion – *B* point (Supramentale)] used to measure the relative position of the maxilla to mandible (Fig. 1). The ANB angle can be also calculated from the formula: ANB = SNA−SNB.

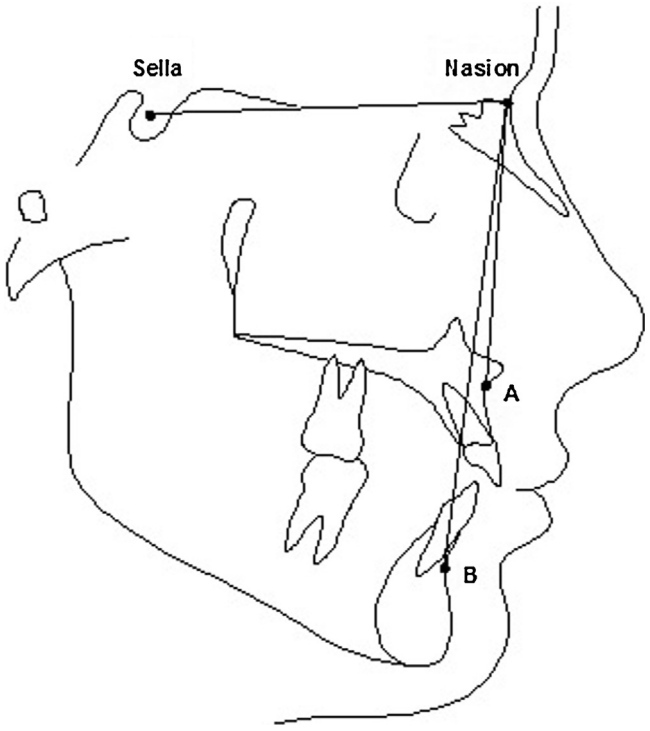

Fig. 1. Graphical illustration of the cephalometric points and angles used in the study.

The ANB angle was used to classify the skeletal relationship between the maxilla and mandible relative to the anterior cranial base (the line joining the Sella and Nasion) as follows; Class I ($1 < ANB < 4$), Class II ($ANB > 4$), Class III ($ANB < 1$).

2.2. Malocclusion

This was classified based on the British standard incisor classification [4] as follows:

Class I: The lower incisal edges occlude with or lie immediately below the cingulum of the upper incisors.

Class II division I: The lower incisal edge occludes behind the cingulum of the upper central incisors and the upper incisors are proclined.

Class II division II: The lower incisal edge occludes behind the cingulum of the upper central incisors, and the upper incisors are retroclined.

Class III: The lower incisal edge occludes in front of the cingulum of the upper incisors.

2.3. Osteotomy type

This was classified broadly as Le Fort I, Bilateral Sagittal split Osteotomy (BSSO), Bimaxilary osteotomy, Genioplasty, and other types (i.e., premax osteotomy, revision CLP).

2.4. Orthodontic treatment need

This was recorded using the Dental Heath Component (DHC) of the IOTN [2].

2.5. Orthognathic functional need

This was recorded using the IOFTN. Table 1 demonstrates the scoring system used in categorising functional needs in orthognathic patients.

2.6. Statistical analysis

Descriptive analyses such as mean, standard deviation were calculated. A histogram was used to show the age distribution of the study sample. The percentages of cases with IOFTN 4/5 in each malocclusion and skeletal pattern category were also calculated.

3. Result

The mean (SD) age at the time of osteotomy for the sample was 21.88 (6.98) years. The age range of the subjects varied from 10 to 54 years old. Fig. 2 shows the histogram of age distribution of study subjects. There were 54 female and 24 males.

Class III malocclusion/skeletal pattern was the most prevalent type (approximately 49%). There were 1, 36, 3, and 38 subjects with Class I, Class II Division I, Class II Division II, and Class III malocclusions, respectively. In terms of sagittal skeletal relationship, there were 2, 37, and 39 subjects with Class I, Class II, and Class III skeletal bases, respectively.

The most prevalent IOFTN score in our sample was the 5.2 (OJ > 9 mm, 29.5%), followed by 5.3 (15.5%), 4.2 (13%), 4.3 (11.5%). Approximately, 89.5% and 89.7% of subjects with Class III malocclusions/skeletal patterns categorized as grade 4 or 5 of IOFTN. Overall, 92.3% were classified as in great and very great functional needs according to the IOFTN (Table 2). Similarly, 84.6% scored as grade 4 or 5, according to the DHC of IOTN (Table 3). Table 4 shows the osteotomy types. The bimaxillary type osteotomy was the most prevalent type (61.5%).

Table 1
Different functional need categories according to the IOFTN [3].

IOFTN Grade	
5	**Very Great Need for Treatment**
5.1	Defects of cleft lip and palate and other craniofacial anomalies
5.2	Increased overjet > 9 mm
5.3	Reverse overjet ≥ 3 mm
5.4	Open bite ≥ 4 mm
5.5	Complete scissors bite affecting whole buccal segment(s) with signs of functional disturbance and or occlusal trauma
5.6	Sleep apnoea not amenable to other treatments such as MAD or CPAP (as determined by sleep studies)
5.7	Skeletal anomalies with occlusal disturbance as a result of trauma or pathology
4	**Great Need for Treatment**
4.2	Increased overjet ≥ 6 mm and ≤ 9 mm
4.3	Reverse overjet ≥ 0 mm and < 3 mm with functional difficulties
4.4	Open bite < 4 mm with functional difficulties
4.8	Increased overbite with evidence of dental or soft tissue trauma
4.9	Upper labial segment gingival exposure ≥ 3 mm at rest
4.10	Facial asymmetry associated with occlusal disturbance
3	**Moderate Need for Treatment**
3.3	Reverse overjet ≥ 0 mm and < 3 mm with no functional difficulties
3.4	Open bite < 4 mm with no functional difficulties
3.9	Upper labial segment gingival exposure < 3 mm at rest, but with evidence of gingival/periodontal effects
3.10	Facial asymmetry with no occlusal disturbance
2	**Mild Need for Treatment**
2.8	Increased overbite, but no evidence of dental or soft tissue trauma
2.9	Upper labial segment gingival exposure < 3 mm at rest with no evidence of gingival/periodontal effects
2.11	Marked occlusal cant with no effect on the occlusion
1	**No Need for treatment**
1.12	Speech difficulties
1.13	Treatment purely for TMD
1.14	Occlusal features not classified above

Table 2
Distribution of the IOFTN functional need categories in the sample.

IOFTN	Score	*N* (%)
	3.2	2 (2.6)
	3.3	4 (5.1)
	4.1	2 (2.6)
	4.2	10 (12.8)
	4.3	9 (11.5)
	4.4	3 (3.8)
	4.8	1 (1.3)
	5.1	6 (7.7)
	5.2	23 (29.5)
	5.3	12 (15.4)
	5.4	6 (7.7)
	Total	78 (100)

Table 3
Distribution of the different orthodontic treatment need categories according to the Dental Health Component (DHC) of the IOTN in the study sample.

IOTN (DHC)	Score	*N* (%)
	3a	4 (5.1)
	3b	8 (10.3)
	4a	7 (9.0)
	4b	5 (6.4)
	4c	1 (1.3)
	4d	9 (11.5)
	4e	7 (9.0)
	4m	3 (3.8)
	5a	23 (29.5)
	5h	1 (1.3)
	5m	4 (5.1)
	5p	6 (7.7)
	Total	78 (100)

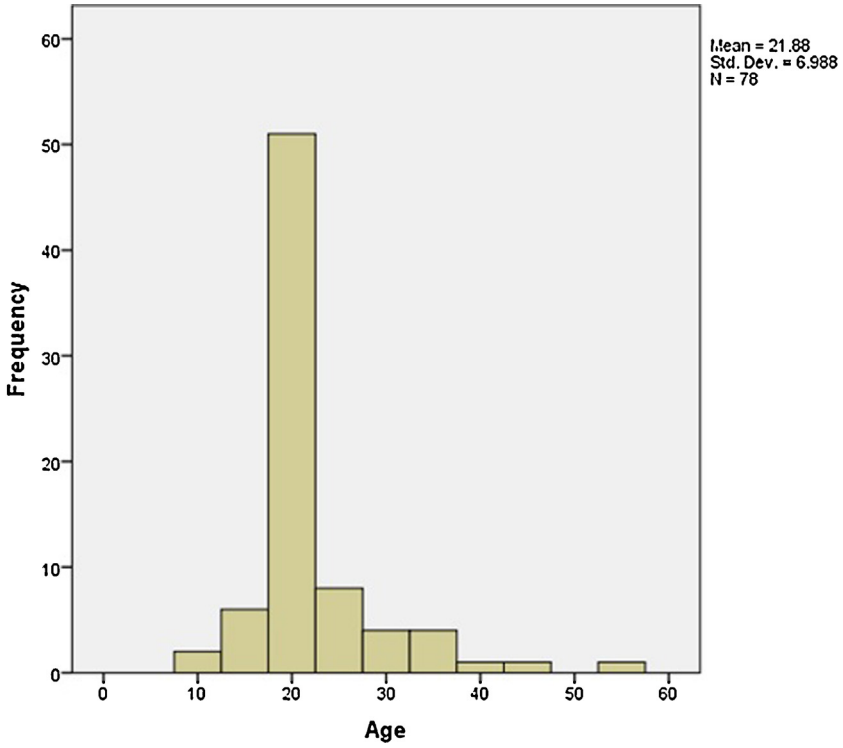

Fig. 2. Age distribution of the study sample.

Table 4
Distribution of the osteotomy types in the sample.

Osteotomy type	*N* (%)
Le Fort I osteotomy	9 (11.5)
Bilateral Sagittal Split Osteotomy (BSSO)	17 (21.8)
Bimaxillary osteotomy	48 (61.5)
Genioplasty	1 (1.3)
Other types (i.e., premax osteotomy and revision CLP)	3 (3.9)
Total	78 (100)

4. Discussion

The dentofacial deformity is defined as a deviation from normal facial proportions and dental relationships that are severe enough to be handicapping [5]. Individuals with dentofacial deformities may experience problems chewing normally, or difficulty comfortably bringing their lips together, swallowing, speaking, or even breathing (sleep apnea). Using an index to allocate the funding to the most needed is extremely important and IOFTN seems to be a simple and reliable type fit for purpose. Ireland et al. [3] decribes the index as follows 'IOFTN applies to those malocclusions that are not amenable to orthodontic treatment alone, due to skeletal deformity, and will ordinarily apply to those patients who will have completed facial growth prior to surgery (commonly 18 years of age and older). IOFTN relates only to the functional need for treatment and should be used in combination with appropriate psychological and other clinical indicators'. To our knowledge, present study is the first reporting on the use of IOFTN. The most prevalent IOFTN score in our sample was the 5.2 [Overjet (OJ) > 9 mm, 29.5%], followed by 5.3 (Reverse OJ ≥ 3 mm, 15.5%), 4.2 (6 mm ≤ OJ ≤ 9 mm, 13%), 4.3 (0 mm ≤ Reverse OJ < 3 mm, 11.5%).

The Class III skeletal pattern was the most prevalent finding in the present sample, accounting for nearly half of the cases. This was similar to individuals with Class III incisor malocclusion, accounting for approximately 49% of the sample. The Class III malocclusion/sagittal skeletal pattern can be due to hypoplastic maxillae, prognathic mandible, or a combination of both, leading to a concave profile [6–15]. In addition, Class III individuals can present with a short anterior cranial base with an acute saddle angle, a normal, excessive, or deficient vertical facial proportions along with proclined maxillary incisors and retroclined mandibular incisors [6–15].

The dominance of Class III individuals in the present sample was similar to the findings of previous studies in the Brazil [16], Saudi Arabia [17], Hong Kong [18], UK [18], Norway [19], and the USA [20]. There seems to be a universal trend for more Class III individuals seeking orthognathic surgery, compared to Class II individuals [20]. This finding suggests that a Class III individual may perceive to have more problems and therefore, requests orthognathic surgery. Certainly, in our sample nearly 90% of subjects with Class III malocclusion/sagittal skeletal pattern categorised as having very great (IOFTN grade 5) or great (IOFTN grade 4) functional need for orthognathic surgery.

According to the IOFTN, 92.3% of our sample were classified as having great and very great functional needs. IOFTN offers unique features such as identifying patients with sleep apnoea who are in need of surgery. For instance, a patient may present with a compensated Class I malocclusion, but with symptoms of sleep apnoea. It appears that the index is a reliable tool to identify patients in need of orthognathic surgery and can be used in resource allocation for patients with highest functional needs. As IOFTN derived from the IOTN, it perhaps has the similar limitations [21,22], as well as limitations associated the lack of assessment of the vertical, sagittal, and transverse 'skeletal' components of the malocclusion.

Conflict of interest statement

Authors have no conflict of interest to report.

Acknowledgement

The orthognathic surgeries in the present sample were carried out by Mr Colin Harrop, Mr James Gallagher, and Mr William Smith.

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