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Dental arch relationships assessed by GOSLON Yardstick in children with clefts in Northern Finland

ABSTRACT

Aim Our purpose was to evaluate the dental arch relationships using the GOSLON Yardstick in children with cleft lip and or cleft palate in Northern Finland.

Materials and methods The subjects consisted of 62 Finnish patients (36 girls and 26 boys) with clefts born between 1995-2005 in the Northern Ostrobothnia Hospital District of Finland. There were 36 patients with cleft palate, 9 with unilateral cleft lip and palate, 6 with cleft in soft palate, 5 with bilateral cleft lip and palate, 2 with cleft lip and 4 with submucous clefts. The study casts were obtained at the mean age of 6.3 years (5.8-7.8 years) and the cases were selected randomly. The dental arch relationships were assessed by the GOSLON Yardstick method by one calibrated researcher.

Results After the assessment, 77.1% of cases were allocated to categories 1 and 2 (excellent and good), 10.4% category 3 (fair), and 12.5% categories 4 and 5 (poor and very poor). Patients with cleft palate had good prognosis in 84.6% of the cases. Of the patients with soft palate clefts and unilateral cleft lip and palate, 66.7% were allocated to categories 1 and 2. Bilateral cleft lip and palate patients had the poorest prognosis. Patients with submucous cleft and cleft lip had all good prognosis.

Conclusion The GOSLON Yardstick is a useful method for assessing dental arch relationships and treatment prognosis not only in cleft lip and palate patients, but also in cleft palate patients.

Keywords Cleft lip and/or palate; Dental arch relationships; GOSLON Yardstick.

Introduction

The most common congenital craniofacial birth defects are cleft lip and/or palate. Generally clefts are classified into two groups, isolated cleft palate (CP) and cleft lip with or without cleft palate (CL/P). The prevalence of CP is 0.4/1000 live births and CL/P 1/700 live births [Gorlin et al., 2001]. In Finland, the prevalence of CP is 0.97/1000 [Mossey and Little, 2002] and it is higher than the average European level. It is generally well known, that cleft lip and/or palate affect both growth of dentofacial structures and development of the anteroposterior and transversal occlusal relationships. Different scoring methods are used for the assessment of dental arch relationship in cleft lip and palate patients, and most of them are based on the presence of crossbite [Matthews et al., 1970; Crabb and Foster, 1977]. There are also methods based on the severity of overjet, overbite and molar occlusion [Bjoerk et al., 1964; Huddart and Bodenham, 1972]. The Huddart/Bodenham method was designed for primary and complete dentition, but it has also been modified for mixed dentition [Mossey et al., 2003]. Another frequently used method is the GOSLON Yardstick (Great Ormond Street, London and Oslo), a reliable clinical tool that categorises the dental arch relationships in the late mixed or early permanent dentition stage into five categories [Mars et al., 1987]. Originally the method was developed for mixed and early permanent dentition, but Atack et al. [1997] adapted the method to 5-year-old children. The GOSLON Yardstick is a simple method for measuring the clinical features that reflect treatment outcomes [Mars et al., 1992; Hathaway et al., 2011]. The outcome is viewed on models and classified into five categories according the method. Of course the definitive outcome of the treatment can be established after facial growth and development of the patient is complete.

While the GOSLON Yardstick has become widely accepted as a tool to assess the outcome of treatment of cleft lip and palate patients, there are very few studies where the method has been used to assess the outcome of isolated cleft palate patients, which represent the most commonly occurring clefts in Northern Finland. It is also important to assess the severity of the malocclusion and treatment prognosis in these patients. Therefore the aim of this study was to evaluate the dental arch relationships using the GOSLON Yardstick in children with clefts in Northern Finland.

Materials and methods

The subjects consisted of 62 Finnish cleft patients (36 girls and 26 boys) with clefts born between 1995-2005 in

the Northern Ostrobothnia Hospital District in Finland. In 36 patients cleft palate (CP) involved hard and soft palate, 9 had unilateral cleft lip and palate (UCLP), 6 with cleft involving only the soft palate (SP), 5 with bilateral cleft lip and palate (BCLP), 2 with isolated cleft lip (CL) and 4 with submucous cleft (SMC) (Table 1); records were taken according to the Eurocleft programme. The study casts were obtained at the mean age of 6.3 years (5.8-7.8 years), SD 0.45 and the cases were randomly selected. Patients had not undergone any orthodontic treatment. The dental arch relationships were assessed and the casts ranked using the GOSLON Yardstick method by one calibrated researcher. According to this method, the clinical features considered most important in characterising malocclusion in the early permanent dentition stages of children with clefts are the anteroposterior arch relationship, the vertical labial segment relationship and the transverse relationship. The models were allocated to five categories according to the method: 1 = Excellent, 2 = Good, 3 = Fair, 4 = Poor, 5 = Very poor outcome [1 Mars et al., 1987]. Group 1 and 2 have occlusions that require simple or no orthodontic treatment, group 3 requires complex orthodontic treatment, but a good result can be anticipated. Patients in group 4 are at the limits of orthodontic treatment without orthognathic surgery to correct skeletal malocclusion, and 5 would need orthognathic surgery to correct the skeletal malrelationship. The casts of 14 patients were excluded, because the deciduous incisors were exfoliated and the permanent incisors had not yet erupted.

Results

Of the entire cohort of cleft patients 77.1% of the cases

Cleft type	n	Girls	Boys
Cleft palate	36 (58.1%)	24 (66.7%)	12 (33.3%)
Soft palate cleft	6 (9.7%)	3 (50%)	3 (50%)
Unilateral cleft lip and palate	9 (14.5%)	4 (44.4%)	5 (55.6%)
Bilateral cleft lip and palate	5 (8.1%)	1 (20%)	4 (80%)
Cleft lip	2 (3.2%)	1 (50%)	1 (50%)
Submucous cleft	4 (6.5%)	3 (75%)	1 (25%)
Total	62	36 (58.1%)	26 (41.9%)

TABLE 1 Distribution of the subjects according the cleft types.

	A	B	C	D	E	F
Score	n (%)	n (%)	n (%)	n (%)	n (%)	n (%)
1	19 (73.1)	2 (66.7)	0 (0)	0 (0)	2 (66.7)	2 (100)
2	3 (11.5)	0 (0)	6 (66.7)	2 (40.0)	1 (33.3)	0 (0)
3	2 (7.7)	1 (33.3)	1 (11.1)	1 (20.0)	0 (0)	0 (0)
4	0 (0)	0 (0)	1 (11.1)	1 (20.0)	0 (0)	0 (0)
5	2 (7.7)	0 (0)	1 (11.1)	1 (20.0)	0 (0)	0
Total	26	3	9	5	3	2

Category	n	%
1	25	52.1
2	12	25.0
3	5	10.4
4	2	4.2
5	4	8.3
Total	48	100

TABLE 2 Distribution of the GOSLON categories.

TABLE 3 Distribution of GOSLON categories according the cleft type. Cleft palate (A), soft palate cleft (B), unilateral cleft lip and palate (C), Bilateral cleft lip and palate (D), Submucous cleft (E), Cleft lip (F).

were allocated to categories 1 and 2 (excellent and good), 10.4% to 3 (fair) and 12.5% to 4 and 5 (poor and very poor) (Table 2). Patients with cleft palate had good prognosis (Group 1 and 2) in 84.6% of the cases, fair in 7.7% of the cases and poor in 7.7% of the cases. Of the patients with soft palate cleft, 66.7% were allocated to groups 1 and 2, and 33.3% to group 3 (fair). Cases with unilateral cleft lip and palate had a good prognosis in 66.7% of the cases, fair in 11.1% of the cases, and in 22.1% of the cases the prognosis was poor. Bilateral cleft lip and palate patients had the poorest prognosis; 40% were allocated to groups 1 and 2, 20% in group 3, and 40% in group 4 and 5. Patients with both submucous clefts and isolated cleft lips all had good prognosis (Table 3).

Discussion

Several methods have been introduced to evaluate and categorise malocclusions in patients with cleft deformities. In the systematic review by Altalibi et al. [2013], the GOSLON Yardstick was found to be a simple and valid method. It was also the most commonly used index with the longest time of use, since it was introduced in 1987 [Mars et al., 1987]. The severity of the initial cleft and also cleft type both affect the prognosis of the occlusion as well as of orthodontic treatment and methods required. Results of studies on the effects of the initial cleft width and severity at birth on the later clinical outcome are variable. Some studies state that the severity of the initial cleft does not correlate with the outcome [Johnson et al., 2000], while other reports suggest a significant relationship between initial cleft severity and maxillary growth [Chiu et al., 2011].

In this study the outcomes of the patients were mostly

excellent and good, representing 77.1% of all cases. Of the remaining subjects, 10.4% of cases had fair prognosis and 12.5% had poor prognosis. When the cases were divided into groups according to their cleft type, cases with submucous cleft and isolated cleft lip all had good prognosis. These groups of patients have a small tissue deficiency and little scar tissue compared to other cleft types, and this accounts for their better prognosis. Patients with unilateral cleft lip and palate (UCLP) had good prognosis in 66.7% of cases, whereas bilateral cleft lip and palate (BCLP) cases had the poorest prognosis, in fact, 40% of these cases the outcome was poor. In BCLP patients, the initial size of the cleft is usually the largest and most severe, so the poor outcome confirms that the initial severity of the cleft will affect the outcome [Peltomäki et al., 2001]. Patients with cleft palate (CP) had good prognosis (Group 1 and 2) in most of the cases (84.6%), fair only in 7.7% of the cases, and poor in 7.7% of the cases. In this study there was a good sample size of cleft palate cases (36 patients).

In Finland the prevalence of isolated cleft palate is the highest in the world. There have been very few studies concerning the GOSLON Yardstick method and its use in cleft palate patients, so it is not possible to compare the results of this study to previous reports. The number of unilateral and bilateral cleft lip and palate patients and other cleft groups was so small (less than 10 cases) than comparison between the results of this study and previous ones is not possible. The problem of small sample size makes evaluation between different institutions difficult, and it has been estimated that a sample size of 42 subjects is required for a two-center GOSLON Yardstick comparison, based on a 5% significance level [Morris et al., 2000; Shaw et al., 1992]. In the reports by Mars et al. [1992], Morris et al. [2000], and Sinko et al. [2008], the age of the cleft patients varied from 8 to 10 years and the sample sizes varied from 35 to 149 patients. The prognosis and outcome in the study by Sinko et al. [2008] was found good (GOSLON 1 and 2) in 71.5% of the UCLP cases and in only 37.1% of cases in the study by Morris et al. [2000].

According to the WHO, the ideal index should have reliability, validity, be accepted by the medical community, require minimal judgement, be suitable to statistical analysis and simple to administer [Summers, 1971]. Some new indexes have been introduced after the GOSLON Yardstick, for example the MHB (Modified Huddart-Bodenham) index in 2003 [Mossey et al., 2003]. Despite the fundamental difference between the MBH and the GOSLON Yardstick, the results have been shown to be highly correlated [Gray and Mossey, 2005]. It is important to assess the severity of the malocclusion and estimate treatment possibilities not only in cleft lip and palate patients, but also in isolated cleft palate patients. The GOSLON Yardstick is a tool which is simple enough, is not time consuming and is also a useful method for treatment planning in cleft palate patients. By estimating treatment plans the GOSLON Yardstick also allows for planning the allocation of orthodontic resources for patients with clefts, including those with isolated cleft

palate. This study gives new information about dental arch relationships and treatment prognosis especially in cleft palate patients. Patients with clefts are followed-up in the Northern Ostrobothnia Hospital in Finland until the age of 18 years, so the reliability and usefulness of the GOSLON Yardstick method in assessing the prognosis of the occlusal development can be evaluated in future studies.

Conclusion

It is important to assess the severity of both malocclusion and treatment prognosis in isolated cleft palate patients. The GOSLON Yardstick is a useful method for assessing dental arch relationships and treatment prognosis in cleft patients in general, but also specifically in cleft palate patients.

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