

Effects of orthodontic experience on the reliability of the GOSLON Yardstick

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ABSTRACT

Objective: The aim of this study was to investigate the importance of the clinical experience on the reliability of the GOSLON Yardstick. **Design:** Comparative-measures study. **Material:** 3D images of the study models of children with complete unilateral cleft lip and palate (n: 119) at an average age of 9 years were included to the study. All subjects had their cleft lip and palate repaired in many hospitals by different surgeons, but no alveolar graft or any orthodontic treatment was performed. **Method:** Digital views of the models were used by OrthoModel software program. 3D images of the study models were scored by two groups of raters (Group I: 10 experienced orthodontists, Group II: 10 post-graduate orthodontic students) after careful perusal of published literature concerning GOSLON scoring and examining dental models samples. **Main outcome measures:** Statistics of intra- and inter-rater agreement. **Results:** Intra-rater agreement measurements of the two groups were high and high inter-rater agreement was also found between the two groups. **Conclusion:** Based on the results of this study clinical orthodontic experience does not affect significantly the reliability of the GOSLON Yardstick when all the raters trained before scoring.

Keywords: GOSLON Yardstick; Unilateral Cleft Palate; Three-Dimensional Images; Clinical Experience

1. INTRODUCTION

The comparison of dental arch relationship of children with cleft lip and palate (CLP) has become a common practice. Beside intercenter studies, a lot of single units from all over the world audit their treatment outcomes to assess performance for the evidence based review of practice and the GOSLON (Great Ormond Street London and Oslo, Norway) Yardstick has become the tool of choice [1-19]. The GOSLON Yardstick was developed

in 1987 by Mars *et al.* to grade dental arch relationships into the five categories in the late mixed and/or early permanent dentition in children with unilateral cleft lip and palate (UCLP). The GOSLON categories range from 1, suggesting an excellent treatment outcome, to 5, suggesting a very poor outcome [20]. According to the GOSLON scale, categories 1 and 2 have occlusions that require simple orthodontic treatments and category 3 needs complex orthodontic treatment. Individuals in the category 4 are at the limits of orthodontic treatment, and orthognathic surgery will generally be necessary; whereas, subjects in the category 5 require combined orthodontic-surgical therapy.

The anteroposterior relationship was considered to be the most important clinically; whereas, vertical and transverse relationships helped discriminate borderline cases [20].

Since its first publication, it has been frequently used worldwide in comparative and outcome assessment studies. It has been proven to be a valid, reliable and reproducible in many settings [8,11,12,17,20]. Although the GOSLON score is an efficient instrument when using by certified raters, the requirement of a substantial degree of professional judgment with regard to the possibility of orthodontic correction, have been suggested as a limitation of the Yardstick [21,22]. However, it has not published yet any study evaluating and proving that suggestion.

Thus, the aim of the present study was to investigate the reliability of the GOSLON Yardstick when used by inexperienced raters. The null hypothesis was “Orthodontic experience does not affect the reliability of the GOSLON Yardstick when all raters trained before scoring.”

2. MATERIALS AND METHOD

3D images of the study models of children with complete unilateral cleft lip and palate (n: 119) at an average age of 9 years (min 8 yrs - max 11 yrs) were included to the

study. All subjects had their cleft lip and palate repaired in many hospitals by different surgeons, but no alveolar graft or any orthodontic treatment was performed.

The dental casts of all patients were scanned. Digital views of the model casts were used by a software program of digital orthodontic dental cast archiving system (OrthoModel V1.01, Istanbul ,TURKEY) (**Figure 1**). The software program allows assessors to analyze the images in every aspect by manipulating the digital models on the computer. Two groups of assessors gathered for GOSLON scoring. Group I consisted of 10 experienced orthodontists with a minimum of 5 years experience in the treatment of cleft lip and palate patients. Group II consisted of 10 post-graduate orthodontic students. For the purpose of training published literature concerning GOSLON scoring was carefully perused and sample models were jointly examined by all the raters. After training period, 3D images of the 119 study models were projected in a conference room. The illustrations and description of GOSLON Yardstick given in the publication of Mars *et al.* (1987) was available for every assessor for inspection during scoring however, no conferring among assessors was allowed 20. Second examination was performed one month later by five assessors from each group. That time each rater assessed the images on a CD using his/her own computer.

The linear weighted kappa statistical test (computing a lower 95% confidence interval [CI]) was used to evaluate intra-and inter-rater reliability scores for the assessors.

3. RESULTS

Intra-rater agreement measurements of the two groups were high (weighted kappa coefficient: 0.89), and high inter-rater agreement was also found between the two groups (weighted kappa coefficient: 0.91). Weighted kappa statistics for inter-rater and intra-rater agreements are shown in **Tables 1-4**. The mean GOSLON score were 3.26 and 3.20 respectively for the Groups I and II and no statistical significance was found between two scoring.

4. DISCUSSION

The need for interdisciplinary treatment for the well being of patient with CLP is very well known [23-26]. However, there is a diversity of treatment protocols applied by different centers worldwide. Improvements in the treatment of cleft lip and palate require the determination of optimal treatment protocols via clinical trials to ensure that such protocols are being successfully applied. Thus, outcome assessment and reporting by cleft lip and palate units are gained more and more importance to assess the efficacy of treatment and whether changes are required [4,15,24,27-32]. Therefore, it is essential to have valid and reliable outcome measures to carry out all the studies mentioned above [15,20,33]. GOSLON Yardstick is a universally accepted tool for the comparison of dental arch relationship outcomes of children with CLP. In the Eurocleft studies, the GOSLON Yardstick

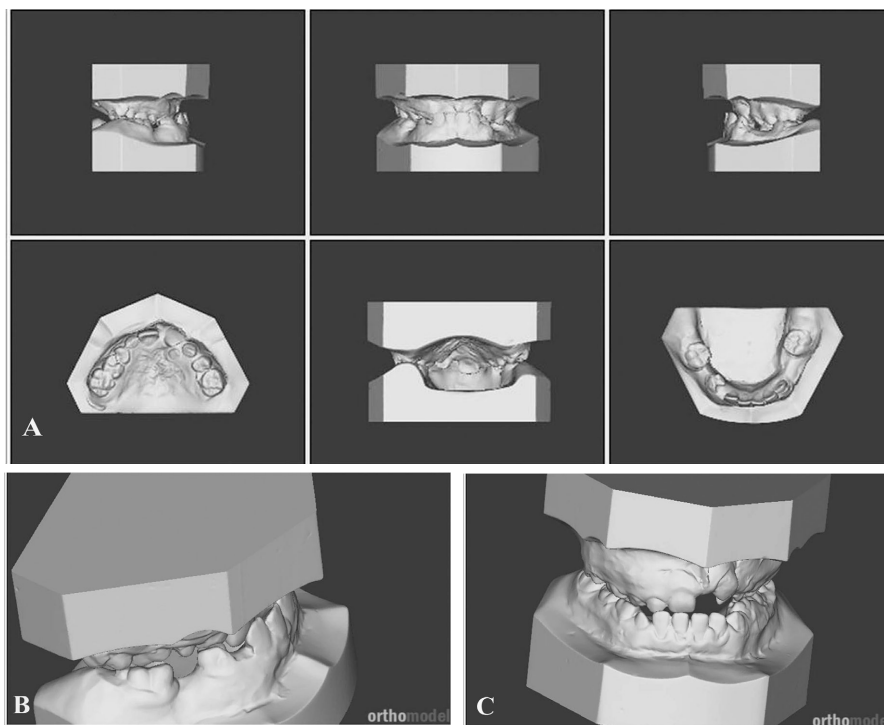


Figure 1. 3D images of dental casts (A): Standard six views, (B,C): Rotated views.

Table 1. Inter-rater agreement for Group I (weighted Kappa statistics).

	A2	A3	A4	A5	A6	A7	A8	A9	A10
A1	0.99	0.99	1	0.99	0.99	1	0.99	0.98	0.99
A2		0.98	0.99	0.98	0.98	0.99	0.98	0.98	0.98
A3			0.99	0.99	0.99	0.99	0.99	0.98	0.98
A4				0.99	0.99	1	0.99	0.98	0.99
A5					0.99	0.99	0.99	0.98	0.98
A6						0.99	0.99	0.99	0.98
A7							0.99	0.98	0.99
A8								0.98	0.98
A9									0.98

Table 2. Inter-rater agreement for Group II (weighted Kappa statistics).

	B2	B3	B4	B5	B6	B7	B8	B9	B10
B1	0.75	0.67	0.76	0.66	0.81	0.77	0.78	0.80	0.77
B2		0.71	0.80	0.79	0.78	0.87	0.82	0.75	0.85
B3			0.79	0.67	0.72	0.73	0.77	0.71	0.74
B4				0.74	0.86	0.84	0.85	0.81	0.81
B5					0.75	0.77	0.81	0.74	0.83
B6						0.82	0.92	0.95	0.78
B7							0.86	0.79	0.84
B8								0.89	0.85
B9									0.77

Table 3. Inter-rater agreement between groups (weighted Kappa statistics).

	Kappa value	Standart error of Kappa	95% Confidence Intervals
Group I			
Versus	0.83 - 0.95	0.08	0.80 - 0.93
Group II			

Table 4. Intra-rater agreement (weighted Kappa statistics).

Groups	Kappa value	Standart error of Kappa	95% Confidence Intervals
I	0.98 - 1	0.08	0.82 - 0.9
II	0.66 - 0.95	0.08	0.73 - 0.83

was found to be a more sensitive tool in discriminating differences in outcomes of dentofacial growth in the participating centers than the cephalometric analysis of the same patients [1,8]. As it is used worldwide in different countries and centers, training of the investigators in scoring GOSLON models have been suggested for standardization of the ratings. Internet course with appropriate photographs of plaster casts of all different GOSLON types have been proposed as an economical alternative [22]. GOSLON was originally applied to dental cast. However, difficulties in traveling the plaster

casts and possible damages lead investigators to use photographic methods. Nollet *et al.* [9] found that “photographs of dental casts provide a consistent, reproducible method for rating arch relationship in patients with UCLP and provide a reliable alternative to the application of the GOSLON Yardstick on dental casts”. The validity and reliability of the intraoral photography method also proved to be good [34,35]. In a recent study Doğan *et al.* [36] showed that 3D images may provide a good alternative to the application of the Goslon Yardstick on dental casts and 2D images. Thus, in this study 3D images of dental casts were used and this allowed the examiners to rotate the images in various directions on the screen and to assess the overjet and overbite relationships more accurately than 2D images [2,34,37].

Ten faculty member orthodontists and ten orthodontic students from different universities rated the 3D images for GOSLON scoring. The main reason of the meeting was to discuss the cleft care in Turkey and give a start to a study comparing dentoalveolar outcomes of patients with UCLP from different regions. Cleft patients are treated mostly in the university clinics in Turkey and orthodontic students get also involved in the orthodontic treatments of those patients.

Thus, it is important that students are able to evaluate treatment outcomes related to orthodontics. It is been suggested that subjectivity based on experience in GOSLON scoring might adversely affect the reliability of the Yardstick [21]. In this study we tended to assess whether orthodontic students can actively involve in the evaluation process of patients with UCLP and whether the GOSLON Yardstick can be reliably used by inexperienced raters. Sinko *et al.* [22] as a part of their study assessing dentoalveolar outcomes of Vienna sample, determined also intra and inter-rater agreement between several raters. They found no significant difference between ratings of an orthodontist and a dental student (0.82). A large weighted kappa value (0.83 - 0.95) was found in our study which indicates a strong agreement between the scoring of the two groups. Intra-examiner agreement was larger for the Group I. However, kappa value was also acceptable for the Group II between two assessments with one month interval. Thus, it appears that personal training of the raters is more important than clinical orthodontic experience to reliably use the GOSLON Yardstick.

5. CONCLUSION

Based on the results of this study clinical orthodontic experience does not affect significantly the reliability of the GOSLON Yardstick when all raters trained before scoring.

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