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Bite force of children with repaired unilateral and bilateral cleft lip and palate

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ABSTRACT

Objective: To assess the bite force (BF) of children with repaired cleft lip and palate (CLP).
Design: Children aged 6–12 years, with and without CLP, were divided into the following 5 groups: (1) control group (CON): 34 children without CLP (17 female, 17 male, mean age 8.2 ± 1.4); (2) cleft lip group (CL): 31 children with cleft lip involving the pre-maxilla (15 female, 16 male, mean age 9.7± 1.3); (3) unilateral CLP group (UCLP): 36 children with complete unilateral CLP (11 female, 25 male, mean age 9.4± 1.6); (4) bilateral CLP group (BCLP): 32 children with complete bilateral CLP (11 female, 21 male, mean age 9.5± 1.7); and 5) cleft palate group (CP): 17 children with complete cleft palate (9 female, 8 male, mean age 9.4± 1.6). Briefly, in this clinical trial, BF was assessed before alveolar bone grafting with a gnathodynamometer (IDDK, Kratos, Cotia, SP, Brazil). For CON, BCLP, CL and CP groups, BF was obtained in the anterior and posterior region of the maxilla. For the UCLP group, BF was assessed in the anterior and posterior regions of both segments. Differences among groups were evaluated by ANOVA test, and Tukey's test was used to assess any correlations among variables ($P < 0.05$).
Results: Unexpectedly, no differences of BF were observed among CON and any of the cleft groups. However, a stronger BF was observed in the CL group when compared to the UCLP and BCLP groups. Next, no differences were observed between the cleft side and the noncleft side in the UCLP group. Lastly, in all groups, BFs from the anterior region of the maxilla were less when compared to the posterior regions.
Conclusion: The BF of children with CLP is no different from children without CLP.

1. Introduction

Cleft lip and palate (CLP) is the most prevalent congenital malformation that affects the stomatognathic system and is characterized by a complete segmentation of the maxilla, leading to maxillary hypoplasia and sagittal and transverse maxillomandibular discrepancies. It is speculated that these changes have a negative effect on the stomatognathic system of such individuals (Trindade-Suedam et al., 2012).

Among the main parameters indicative of the stomatognathic system functionality is the quantification of bite force (BF), an important method for measuring the masticatory function, as a quantitative indicator (N) of masticatory performance (van der Bilt, Tekamp, van der Glas, & Abbink, 2008). BF is directly related to certain conditions such as craniofacial morphology, occlusal pattern, gender, age (Sun et al., 2015), periodontal status, number of teeth present or even to the type of dental prosthesis in use (Boven, Raghoebar, Vissink, & Meijer, 2014; Hatch, Shinkai, Sakai, Rugh, & Paunovich, 2001; Suzuki, Taniguchi, & Ohyama, 1995). Clinically, BF is a parameter indicative of therapeutic success in dental rehabilitation procedures such as orthognathic surgery or oral rehabilitation with dental implants (Rismanchian, Bajoghli, Mostajeran, Fazel, & Eshkevari, 2009). For example, when oral rehabilitated patients present similar BFs when compared to healthy individuals, the rehabilitation process can be considered successful.

Previous research conducted in our laboratory (Sipert, Sampaio, Trindade, & Trindade, 2009) has shown that BF is significantly

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reduced in male subjects with CLP when compared to noncleft individuals. However, important variables such as age and the execution of the alveolar bone grafting surgery, which unifies the maxilla into one structure, were not controlled. Notably, studies assessing BF in children with CLP, especially in bilateral cases (which represent the most severe type of cleft) were absent in the literature.

Considering that the segmentation of the maxilla might be a limiting factor of the stomatognathic system function in subjects with CLP, the objective of this study was to quantify the BF of children with different types of CLP without alveolar bone grafting, from the Hospital for Rehabilitation of Craniofacial Anomalies at the University of São Paulo (HRAC/USP), Bauru, SP, Brazil. It was hypothesized that children with clefts, independent of cleft type, would have lower bite force values when compared to children without clefts.

2. Material and methods

This study was approved by the Institutional Ethics Review Board of the HRAC/USP, (process number 768.103), according to Resolution 466/12 of the National Health Council. All participants and their legal guardians were informed about the procedures involved in the study and signed an informed consent form before examinations.

Considering an alpha error of 5%, a beta error of 20%, and adopting an expected standard deviation of 3 kgf and significant difference between groups of at least 5 kgf (Palinkas et al., 2010), an estimated sample size of 10 subjects per group was obtained.

Inclusion criteria were the following: children without CLP, children with nonsyndromic unilateral or bilateral CLP, unilateral cleft lip, cleft palate, children in the mixed dentition phase, children without tooth decay and periodontal disease, and children having interocclusal molar relation. Exclusion criteria were the following: pain or discomfort during the exam, Angle class II and III malocclusions, presence of large restorations or endodontic treatment, tooth loss, inability to understand orientations during the exam, alveolar bone grafting and children with systemic diseases.

Briefly, 150 children, from both genders, aged 6–12 years, with and without CLP, were divided into the following 5 groups: (1) control group (CON): 34 children without CLP (17 female, 17 male, mean age 8.2 ± 1.4); (2) cleft lip group (CL): 31 children with cleft lip involving the pre-maxilla (15 female, 16 male, mean age 9.7 ± 1.3); (3) unilateral CLP group (UCLP): 36 children with complete unilateral CLP (11 female, 25 male, mean age 9.4 ± 1.6); (4) bilateral CLP group (BCLP): 32 children with complete bilateral CLP (11 female, 21 male, mean age 9.5 ± 1.7); and (5) cleft palate group (CP): 17 children with complete cleft palate (9 female, 8 male, mean age 9.4 ± 1.6).

Children from the cleft groups were regularly registered at a tertiary hospital specialized in the treatment of cleft lip and palate patients (Hospital for Rehabilitation of Craniofacial Anomalies, University of São Paulo, Brazil). In turn, children from the control group were from the Pediatric Dentistry Clinic, Bauru School of Dentistry, University of São Paulo, Brazil.

In this clinical trial, children were submitted to a BF exam using a gnathodynamometer (digital dynamometer, IDDK model, Kratos, Bauru, SP, Brazil) with a capacity of ~100 kgf (~980 N) (Fig. 1). This gnathodynamometer is composed of a stainless steel cylinder (10 × 10 mm) which contains a load cell that measures force when deformed. Measurements were performed 3 times with an interval of about 1 min between measurements to avoid fatigue (Roldán, Buschang, Saldarriaga Isaza, & Throckmorton, 2009; Roldán, Restrepo, Isaza, Vélez, & Buschang, 2015), been this lapse of time sufficient to avoid fatigue (Roldán et al., 2009). For the CON, BCLP, CL and CP groups, BF was obtained in the anterior and posterior region of the maxilla. For the UCLP group, BF was assessed in the anterior (Fig. 2 and 3) and posterior regions of both segments (Fig. 4). The locations of the measurements are illustrated in Fig. 5. Importantly, every child was naïve to the BF exam and was given the same detailed instruction and amount of practice using the apparatus.

Fig. 1. Gnathodynamometer used to perform the measurements (digital dynamometer, IDDK model, Kratos, Bauru, SP, Brazil).

Fig. 2. Location of measurements for the UCLP group: central incisors (anterior region of the maxilla).