ARTICLE IN PRESS

Original article

Masticatory function parameters in patients with varying degree of mandibular bone resorption

Raissa Micaella Marcello-Machado [a], Amália Machado Bielemann [a], Gustavo Giacomelli Nascimento [b], Luciana de Rezende Pinto [c], Altair Antoninha Del Bel Cury [d], Fernanda Faot [b],*

[a] Graduate Program in Dentistry, Federal University of Pelotas, Pelotas, Brazil
[b] Department of Semiology and Clinics, School of Dentistry, Federal University of Pelotas, Pelotas, Brazil
[c] Department of Restorative Dentistry, School of Dentistry, Federal University of Pelotas, Pelotas, Brazil
[d] Department of Prosthodontics and Periodontology, Piracicaba Dental School, University of Campinas, Piracicaba, Brazil

ARTICLE INFO

ABSTRACT

Purpose: This cross-sectional study analyzes how bone resorption affects the masticatory function and investigates the relation between perceived and measured masticatory function.

Methods: Thirty complete dentures wearers were divided in two groups according to mandible bone atrophy based on the classification criteria from Cawood & Howell. Retention and stability of the mandibular complete denture, masticatory performance (MP) indexes (X_50 and B) and masticatory efficiency (ME, sieves 4 and 2.8) were evaluated. Geriatric Oral Health Assessment Index (GOHAI) and Dental Impact on Daily Living (DIDL) questionnaires were completed by the patients.

Results: A strong correlation between bone atrophy and poor retention was found (P=0.0132). Neither masticatory performance indexes nor GOHAI and DIDL domains showed statistical differences (P>0.05) when patients were compared according to the atrophy criteria. Mandibular length showed a negative correlation with ME4, showing a positive association (R^2=0.17, β=−0.67, P=0.029). Mandibular denture retention was significantly correlated with MPB (P=0.01) and ME2.8 (P=0.01). GOHAI showed a positive association between the physical and the functional domains and ME2.8 (R^2=0.17; β=1.22; P=0.02). DIDL showed a negative association between ME4 and oral comfort domain (R^2=0.16; β=−2.94; P=0.02).

Conclusion: Mandibular bone height does not directly affect the masticatory function and is inversely correlated with the self-perceived masticatory ability.

© 2016 Japan Prosthodontic Society. Published by Elsevier Ltd. All rights reserved.

* *Corresponding author at*: Department of Restorative Dentistry, School of Dentistry, Federal University of Pelotas, Gonçalves Chaves St 457, Center, Pelotas 96015560, RS, Brazil. Fax: +55 53 32256741.
E-mail address: fernanda.faot@gmail.com (F. Faot).

1. Introduction

Complete denture wearers have a reduced masticatory function by 50–84% compared to dentate patients [1]. Impaired mastication can be related to the lack of stability and retention of the prosthesis [2]. The latter is directly affected by progressive resorption of the residual alveolar bone [3]. Additionally, the patient's inability to use a new complete denture, tongue mobility problems related to the height towards the base of the mouth, muscles insertions and salivary flow can have a negative impact on the adaptation phase. All these factors can contribute to a poor chewing function and pain, resulting in dissatisfied patients [4].

The success of rehabilitation with conventional complete dentures depends directly on the intimate relationship between the prosthesis and the anatomical structures that support it: the residual ridge, the mucosa and the adjacent musculature [5]. However, residual ridge resorption is chronic, multifactorial, progressive and eventually necessitates cumulative bone remodeling [6]. As a consequence, the prosthesis loses stability and starts to move during mastication, which frequently results in discomfort. This discomfort occurs because the muscle insertions become more superficial, and the mucosa presents thinner and more sensitive, resulting in pressure ulcers, hyperplasia and denture stomatitis [3,4,6].

Clinicians frequently use panoramic radiography to define and to monitor the severity of bone resorption in edentulous patients. The degree of residual ridge resorption also determines the prognosis of oral rehabilitation in edentulous patients [6], be it a conventional complete denture or implant-supported. In addition, prolonged edentulism in combination with low frequency of prostheses replacement may occasionally result in the development of fibrous tissue. This resilient tissue can interfere in the settlement, stability and comfort of the mandibular prosthesis during chewing. The resulting mobility of the mandibular prosthesis during chewing can trigger trauma and pain in extremely resorbed bone areas, limitation of occlusal forces, difficulties to homogenize food. These factors directly affect the quality and masticatory performance, especially in edentulous patients with severe mandibular bone atrophy [7].

Some studies have indeed shown the negative influence of bone resorption on the masticatory function and suggest that masticatory function in complete denture wearers is limited due to residual ridge resorption and the decrease of basal area of the complete denture [8,9]. However, these studies categorized the patients based on a clinical evaluation or based on a morphological description of the alveolar ridge using cast models. We present one of the first studies that compares objectively evaluated masticatory function with the subjective account of the patient regarding their chewing ability.

It is still debated whether the masticatory function is influenced by residual ridge resorption in edentulous patients and whether indexes related to objective masticatory function are related to the self-perceived efficient chewing. This cross-sectional clinical study evaluated the degree of mandibular bone atrophy of edentulous patients and examined the relation between the level of bone resorption and the masticatory function. In addition, the indexes of masticatory function (masticatory performance and efficiency) were compared with information related to the subjective perception of the patient (DIDL questionnaires – Dental Impact on Daily Living and GOHAI – Geriatric Oral Health Assessment Index) about their masticatory efficiency.

2. Material and methods

2.1. Experimental design

This cross-sectional clinical study was conducted in accordance with the Declaration of Helsinki, as revised in 2008, and reported following the Strengthening the Reporting of Observational Studies in Epidemiology guidelines [10]. This study was approved by the Ethics Committee in Local Search (69/2013) and included conventional dentures wearers attending the Complete Denture Clinic at the School of Dentistry/UFPel under treatment from February 2013 to April 2014. Patients in good general health and wearing conventional complete dentures for at least three months were included in the study, if these patients showed difficulties adapting to mandibular complete dentures.

A written informed consent form was obtained from patients that fulfilled the inclusion criteria wherein they agreed to the terms of research. Subsequently, radiographic evaluations, functional tests on retention and stability of dentures, masticatory function tests and questionnaires, which comprise subjective evaluation of the masticatory domain, were conducted.

The patients were categorized into two groups with non-atrophic and atrophic jaws, based on radiographic measurements. The dependent variables consisted of the evaluation of retention and stability of the mandibular complete dentures, masticatory efficiency and performance parameters and questionnaires regarding the impact on daily life (DIDL) and self-perceived oral health (GOHAI).

Sample size calculation was based on a previous study [8] using the following parameters: smallest expected difference between means, standard deviations of the difference between means, beta error of 10% and one-tailed alpha error of 5%. The sample size was increased by 20% to account for potential losses and refusals. These calculations determined a minimum of 12 participants were required per group for this cross-sectional study.

2.2. Radiographic evaluation and categorization of mandibular bone atrophy

After performing the digital panoramic radiographs (Rotograph apparatus Plus, with digital imaging plate system Dentascan sensors with 12.7×30 cm dimensions), radiographic measurements related to morphology and mandibular height were performed in DBSWIN software (digital system VistaScan) by a single calibrated examiner, according to the methodology described by Xie et al. [11] (Fig. 1A). The measured parameters were: mandibular body length, height in the anterior (midline) and posterior (molar region), and superior height of the foramina (distance from the top edge of mentonian foramen to the alveolar ridge). Based on these