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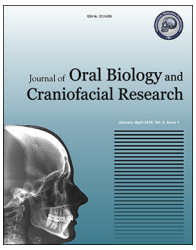

Original Article

Teeth movement in denture and implant-supported prosthesis influenced by microwave flask systems

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ABSTRACT

Background/Aims: This study evaluated the teeth movement in maxillary dentures and mandibular implantsupported prostheses processed by microwave flasks.

Methods: A model mounted on articulator was used to manufacture Co-Cr frameworks. Pins were placed for measurements on the incisal edge of upper and lower central incisors (I), buccal cusp of first upper and lower premolars (PM), and mesiobuccal cusps of upper and lower second molars (M). Distances I-I (incisor to incisor), PM-PM (premolar to premolar), M-M (molar to molar), RI-RM (right incisor to right molar), and LI-LM (left incisor to left molar) were measured before and after processing using a microscope (0.0005 mm). Vertical misfit between abutment and implant platform was evaluated for regions A (left distal implant), B (left median implant), C (medial implant), D (right median implant), and E (right distal implant) in predetermined labial and lingual sites. Prostheses were divided into groups G1 – conventional flask, and G2 – experimental HH flask. Acrylic resin was microwaved at 1400 W (30% for 3 min, 0% for 3 min, and 60% for 3 min). Horizontal teeth displacement and vertical misfit between abutment and implant platform were considered before and after procedures. Data were submitted to three-way ANOVA and Tukey's test ($\alpha = 0.05$).

Results: Except for M-M distance, the teeth showed displacements without statistical difference for prosthesis and flask factors. There was no significant difference for vertical misfit values for both flasks.

Conclusion: Diferente flasks did not cause significant changes in the teeth displacement, except for M-M. Vertical misfit values were not influenced by the flasks.

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1. Introduction

Acrylic resin has been considered as an ideal material for dental prostheses manufacturing due to lower cost, color stability for long time, simple technique of manipulation, and adequate physical and mechanical properties.[1] However, the main disadvantage of this polymeric material is the polymerization shrinkage that causes dimensional change in the denture base,[2] and teeth displacement.[3]

It has been alleged that the teeth artificial displacement can promote several drawbacks, such as increase of the vertical occlusal dimension. A dimensional vertical change of 0.25 mm in the posterior region would result in an increase of 1 mm in the vertical position of the incisal pin.[4] In addition, the teeth displacement[3,5] can also cause interferences that induce traumatic occlusion, responsible for the irregular distribution of stresses to the support tissues, causing discomfort and affecting the patient's masticatory function.

Dimensional changes of the acrylic resin base occur during the polymerization and deflasking procedure. This fact is assigned to acrylic resin shrinkage,[6] and to other factors that can cause changes in the denture base and in the teeth position during and after the prosthesis manufacturing.[7,8] By this reason, a classic study,[9] and other more recent[10,11] studies, verified the effect of methods and techniques to eliminate or minimize the dimensional changes arising from the laboratory processing, but without significant result or even relevance.

Conventional dentures show some deficiencies in retention and stability, while the implant-supported prostheses present better stability due to retention promoted by the implants. However, this prosthetic rehabilitation was also manufactured with acrylic resin that shows dimensional change inherent to the polymeric material. In addition, the changes that occur on the denture base due to factors as polymerization cycle,[12] base thickness and amount of residual monomer,[13] closure flask method,[14,15] and commercial types of acrylic resin,[16] as well as those that occur on teeth displacement as inclusion and polymerization,[17] and closure and flask cooling,[18] can, by analogy, interfere on the teeth displacement in implant-supported prostheses.

Associated to dimensional acrylic resin changes, the other factor that must be considered significant, in relation to implant-supported prosthesis, is the passive fit of the metal bar on the implants. This fact is critical for the success of the prosthetic rehabilitation, considering that the absence of passive fit can promote different levels of bone resorption, loosening, or fracture of the prosthetic screws, and even abutment or implant fractures.[19–21]

The dental literature shows few studies concerning the teeth displacement due to different flask systems. Therefore, a study would be convenient and timely to verify in maxillary conventional dentures and mandibular implant-supported prostheses the teeth displacement (transverse and antero-posterior) and the vertical misfit between abutment and implant platform (buccal and lingual) influenced by traditional and experimental microwave flask systems.

The work hypothesis was that different microwave flask systems would promote similar levels of teeth displacement in conventional denture and implant-supported prosthesis, as well as in the vertical misfit between abutment and platform implant.

2. Materials and methods

From an arch-shaped mandibular model with five external hexagon analogs (Conexao, Sao Paulo, SP, Brazil) with 4.1 mm platform (4 mm in diameter and 11 mm in length) were manufactured frameworks of Cr–Co alloy (Star Loy C; DeguDent, Germany) for implant-supported prosthesis using casting by the lost wax technique. After framework finishing and polishing, the teeth (Trubyte Biotone 3P/32L; Dentsply, Rio de Janeiro, RJ, Brazil) were mounted in relation to conventional maxillary complete denture using semi-adjustable articulator (A7 Plus; BioArt, Sao Carlos, SP, Brazil) according to the following guides: Bennett angle of 15°, condylar angle of 30°, and incisal pin at 0° (touching the incisal table). From this configuration of complete denture and fixed implant-supported prosthesis was obtained a silicone mold (Zetalabor; Zhermack, Rovigo, Italy) used for standardizing the teeth position of all other pairs of prostheses. Twenty sets of prostheses were divided into two groups, according to flask system ($n = 10$).

After obtaining the waxed prostheses, the sets were placed on the articulator as previously described. Following this, metal pins were placed as reference for transverse measurements on the incisal edge of the upper and lower central incisors (I), buccal cusp of the first upper and lower premolars (PM), and mesiobuccal cusps of the upper and lower second molars (M).

The distances I-I (incisor to incisor), PM-PM (premolar to premolar), M-M (molar to molar), RI-RM (right incisor to right molar), and LI-LM (left incisor to left molar) were measured before and after prostheses processing using a linear optical microscope (STM; Olympus, Tokyo, Japan) at accuracy of 0.0005 mm. Under the same measurement conditions, the vertical misfit between abutment and implant platform was evaluated in the regions A (left distal implant), B (left median implant), C (medial implant), D (right median implant), and E (right distal implant) in labial and lingual predetermined points.

The inclusion for prostheses processing in conventional flask for microwave (Classico; Classico, Sao Paulo, SP, Brazil) was according to traditional method,[1] and in experimental microwave flask (HH; teeth in occlusion) it was according to a previous study.[5] The acrylic resin for microwave (Onda Cryl; Classico) was proportioned and manipulated according to manufacturer's recommendations in the proportion of 3:1 in volume (21 mL of polymer:7 mL of monomer), inserted in the flask in plastic stage, and microwaved at 1400 W (AW-42; Continental, Manaus, AM, Brazil) according to the polymerization cycle recommended by the manufacturer (30% of potency for 3 min, 0% of potency for 3 min, and 60% of potency for 3 min). After acrylic resin polymerization, the flask was cooled at room temperature, the prostheses deflasked, finished, and related on the articulator (BioArt).

The dimensional changes of the distances between teeth or between abutment and implant platform after the processing