

Influence of the use of dental prostheses in balance and body posture.

Influência do uso de próteses dentárias no equilíbrio e na postural corporal

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Abstract

Introduction: The concept of body posture involves balance, neuromuscular coordination and adaptation. Automatic postural responses are adjusted to meet the needs of interaction between systems of postural organization and the environment. Postural control is to maintain body position seeking stability and orientation in space, and the maintenance of posture and balance is directly related to three main systems: visual, vestibular and proprioceptive, whose junction ensures body balance. Other factors may be related to this control, such as the use of prostheses, among them the dentures that provide the balance of the mouth and jaws, through neuromuscular balance, helping to balance the body as a whole. Stabilometry assesses postural balance through the quantification of postural sway in the orthostatic position on a force platform. **Objective:** To evaluate the influence of the use of dental prostheses in maintaining balance and posture through baropodometry. **Method:** The study included 10 women with an average age of 65 years old, all using dental prosthesis, which remained on the platform for 30 seconds, with the prosthesis, repeating the procedure without the use of the prosthesis. **Results:** As the postural balance is given by the sum of the balance of all body structures, where all must be wholesome, and may include dental arch, in this case replaced by dental prosthesis, there was a direct contribution of using it over body balance as a whole, since there was a decrease in the number of oscillations of the body centroid and radial displacement, among individuals who use dental prosthesis. **Conclusion:** The present study demonstrated that there is a direct influence of the use of dental prostheses on posture and body balance.

Keywords: dental prosthesis, baropodometry, balance.

Resumo

Introdução: A postura corporal envolve conceito de equilíbrio, coordenação neuromuscular e adaptação. As respostas posturais automáticas são ajustadas para ir ao encontro das necessidades de interação entre os sistemas de organização postural e o meio ambiente. O controle postural consiste na manutenção da posição do corpo buscando estabilidade e orientação no espaço, sendo que a manutenção da postura e do equilíbrio está diretamente relacionada a três sistemas principais: visual, vestibular e proprioceptivo, cuja junção garante o equilíbrio corporal. Outros fatores podem estar relacionados a este controle, como o uso de próteses, dentre elas as próteses dentárias que estabelecem o equilíbrio da boca e maxilares, por meio do equilíbrio neuromuscular, contribuindo para o equilíbrio corporal como um todo. A estabilometria avalia o equilíbrio postural através da quantificação das oscilações posturais na posição ortostática numa plataforma de força. **Objetivo:** Avaliar a influência do uso de próteses dentárias no equilíbrio e manutenção da postura corporal através da baropodometria. **Método:** Participaram do estudo 10 mulheres com idade média de 65 anos, todas utilizando prótese dentária, as quais permaneciam por 30 segundos na plataforma com a prótese, repetindo o procedimento sem o uso da prótese. **Resultados:** Como o equilíbrio postural se dá pela somatória do equilíbrio de todas as estruturas corporais, onde todas devem estar íntegras, podendo incluir a arcada dentária, neste caso substituída pela prótese dentária, houve contribuição direta do uso da mesma sobre o equilíbrio corporal como um todo, visto que houve diminuição no número de oscilações do baricentro corporal, e deslocamento radial, entre os indivíduos que utilizam prótese dentária. **Conclusão:** O presente estudo demonstrou que há influência direta do uso de próteses dentárias sobre a postura e o equilíbrio corporal.

Palavras-chave: prótese dentária, baropodometria, equilíbrio.

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INTRODUCTION

Body posture involves concepts of balance, neuromuscular coordination and adaptation, which represent a determined body movement. Automatic postural responses are dependent on the context. In other words, they are adjusted to meet the needs of interaction between postural organization systems (balance, neuromuscular and adaptation) and the environment.⁽¹⁾

Postural control consists of controlling the position of the body while seeking stability and orientation in space. Maintaining balance in static conditions means having a center of gravity (CG) projected in the support area. In order to maintain balance in the orthostatic position, the nervous system needs to synergistically maintain motor control over actions of the joints and muscles. Thus, the maintenance of posture and balance is directly associated with three principal systems: visual; vestibular and proprioceptive, the junction of which ensures body balance.⁽²⁾

However, other factors can be associated with this control, including the use of dentures. Dentures establish the balance of the mouth and jaw through neuromuscular balance, contributing to body balance as a whole.⁽³⁾

The use of dentures is very common among the elderly. They are mainly used for aesthetic purposes but can be used for their functionality in relation to eating and verbal communication. Despite advances in public oral health policies, Brazil still has a high number of partially or completely edentulous individuals, together with a need for the large-scale production of dental prostheses. Dentures ensure the functional and aesthetic rehabilitation of the patients.⁽⁴⁾ The importance of teeth to the identity and ego of people has shown that when patients seek dental resources to substitute lost teeth, they are also demanding the reconstruction of their personal and social image.⁽⁵⁾

Stabilometry has been used by many authors in studies and clinical assessments. It measures the vestibular-spinal function, providing indispensable complementary data for the assessment of patients with dizziness, while also analyzing sensory interactions. Stabilometry assesses postural balance through the quantification of postural oscillations in the orthostatic position on a force platform. This involves monitoring displacements of the pressure center (PC) in lateral (X) and antero-posterior (Y) directions through baropodometry, using an apparatus that provides biomechanical and structural analysis of possible anomalies in gait and posture.^(6,7)

The aim of the present study was to assess the influence of the use of dentures on balance and body posture using baropodometry.

METHODS

The final sample contained 10 institutionalized women with a mean age of 65 years. The all weighted between 75

and 85 kg and exhibited no severe postural problems, deformities or balance abnormalities such as labyrinthitis. All ten women used upper and lower dentures.

The individuals were asked to climb onto the Footwork platform with their feet aligned, stay as relaxed as possible and look at a fixed point straight ahead of them for 30 seconds. After data collection, the elderly individuals removed their dentures to repeat the procedure, again for 30 seconds.

A Footwork baropodometer with the following characteristics was used in the present study: an active surface of 400/400 millimeters (dimensions 645x520x25mm); 704 calibrated capacitive pickups; frequency of 150Hz; maximum pressure per capacitor of 100 N/cm²; 16 bit analog converter; capacitor measurements of 7.62x7.62mm; USB connection and charging, a weight of 3 kg and a thickness of 5 mm. The calibration of the apparatus was performed based on the weight, height and shoe size of the elderly individuals. The stabilometric parameters assessed were associated with body displacement in the anterior, posterior and lateral directions.

Statistical Analysis

Origin 8.0 software was used for the statistical analysis. The Kolmogorov-Smirnov test was used to confirm the normality of the sample, followed by the paired t-test.

RESULTS

Table 1 displays the displacement speed of the body barycenter, which corresponds to the center of gravity of the body where all attraction forces balance. In the group with no dentures (GSP), there was a greater mean value ($p=0.0142$) recorded than in the group with dentures (GCP). Displacement speed (P) is defined as the mean distance covered per second during the period of the sample and is represented in the following formula:

$$P = \frac{f}{(N-1)} \sum_{i=1}^{N-1} \sqrt{\{(x_{i+1} - x_i)^2 + (Z_{i+1} - Z_i)^2\}}$$

Table 2 displays the radial displacement and movement from inside to out and from the center to the edges. The GSP exhibited a greater displacement value than the GCP ($p=0.042$). The formula used⁽⁸⁾ to calculate the values of radial displacement (Rd) is as follows:

$$Rd = \frac{1}{N} \sum_{i=1}^N \sqrt{\{(x_i - x_c)^2 + (z_i - z_c)^2\}}$$

$$x_c = \frac{1}{N} \sum_{i=1}^N (x_i) \quad z_c = \frac{1}{N} \sum_{i=1}^N (z_i)$$

Table 1. Travel speed of the body barycenter.

Travel speed	GCP	GSP
Mean	1.52	1.77
Standard Deviation	0.15	0.19

Subtitle: GCP = group with dentures; GSP = group with no dentures

Table 2. Radial travel speed (Rd), mean and Standard deviation

Radial travel speed (Rd)	GCP	GSP
Mean	1.52	1.77
Standard Deviation	0.15	0.19

Subtitle: GCP = group with dentures; GSP = group with no dentures.

DISCUSSION

Studies have suggested that the increase in body oscillations among the elderly is an indication of abnormalities in the postural control system. Although there is evidence that indicates a decreased performance of the postural control system in the elderly, the reasons for this decrease have not yet been completely clarified.^(9,10)

Freitas and collaborators (2006) stated that balance could be partially or completely compromised due to abnormalities that occur as a result of the aging process. A number of causes suggested for the decreased performance in the postural control of the elderly are associated with structural and functional abnormalities in the sensory system and the motor system.⁽¹¹⁾ In the present study, edentulism, together with the physiological abnormalities that occur during the aging process, was confirmed as a cause of body posture abnormalities in the elderly.

The teeth are indispensable structures for the balance of muscles, joints and ligaments. Any dental ab-

normality, such as crooked teeth, malocclusion and especially, the absence of teeth, generates muscle imbalances that may result in complications, such as temporomandibular disorders, which affect the masticatory muscles, the temporomandibular joint and adjacent structures.⁽¹²⁾ The increased activity of the masticatory muscles affects the sternocleidomastoid and trapezius muscles, leading to a shortening of the posterior neck muscles and a stretching of the anterior neck muscles, resulting in an anterior projection of the body, displacing the center of gravity.⁽¹³⁾

The proposed study describes the fact that an absence of teeth can be considered as a primary factor in face and neck muscle imbalances, resulting in an abnormal center of gravity and consequently, balance abnormalities.

Amantéa and collaborators (2004) stated that the orthostatic position is maintained by complex muscular mechanisms involving muscles of the head, neck and scapular waist. As a result of these intimate relationships, any abnormality in one of these structures leads to a postural imbalance in the area and also in other muscle chains of the body.⁽¹⁴⁾

In the present study, there was a significant difference in the oscillations of the body barycenter and the radial displacement between individuals with and without dentures. Thus, the presence of a full set of teeth has a great effect on posture and body balance, as well as promoting better eating habits and self-esteem in the elderly.

CONCLUSION

The present study showed that that use of dentures has a direct affect on posture and body balance since all body structures must be healthy in order to maintain the body balance of each segment and body homeostasis.

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