Original Article

A Comparative Study of Chewing Efficiency using 3 Evaluation Methods

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Abstract

The purpose of this study was to compare 3 chewing efficiency evaluation methods and determine if there was any correlation between their results when testing under the same group of subjects. The test items used in the 3 methods were red /green wax cubes (system 1), chewing gum (system 2) and red/white wax cubes (system 3). Seventeen subjects wearing lower unilateral distal extension removable dental prostheses (RDP) (4 males and 13 females, mean age 56.59±10.79 years) participated in this study. The subjects were asked to chew the test items in system 1 to system 3 for 10, 25 and 10 strokes respectively in the same visit in the order of systems 1, 2, and 3. Subjects were asked to chew the test items on each side (left and right) with and without their lower prostheses. The chewing efficiency obtained from system 1, 2 and 3 were mixing ability index (MAI), mean a* (the value of green-magenta axis) and percentage of chewing ability, respectively. Statistical analysis revealed a significant difference ($p < .05$) in chewing efficiency between chewing with and without prosthesis with all three chewing efficiency test systems. Pearson's correlation coefficients between systems showed the three systems were significantly related to each other ($p < .05$). Also, this study revealed that any of the three chewing efficiency systems could be alternatively used depending on the circumstances or the economic base of investigating group. Our results suggested that the two-colored (red/white) wax cube system was the one option for evaluating the chewing ability.

Introduction

Original Article

Influence of Orthodontic Miniscrew Implant Sizes and Loading Forces on Stress Distribution: Finite Element Method

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Abstract

The miniscrew implant has become an alternative mechanism for providing maximum anchorage in orthodontics. Recently, a wide variety of miniscrew implants with several sizes and designs have been developed for clinical use. However, changes in the geometry of miniscrews may influence the biomechanical properties of both the miniscrew implant and surrounding bone. Therefore, the purpose of this study was to evaluate the influence of the miniscrew implant diameters, lengths and loading forces on the stress distribution in bones and miniscrew implants using finite element method. Twenty-five models featuring miniscrew implants of various sizes (1.0, 1.2, 1.4, 1.6 and 1.8 mm. in diameter and 4.0, 6.0, 8.0, 10.0 and 12.0 mm. in length) and surrounding bone were created and loaded with 50 to 400 g forces perpendicular to the longitudinal axis of the miniscrew implants in order to investigate resultant stress distribution. The results showed that stresses were concentrated mainly around the cervical portion of the body of the miniscrews. In the surrounding bone, stresses were concentrated in the upper part of the cortical bone on the same side as the force vector; whereas stress concentration in cancellous bone was not detected. Increasing the diameter of the miniscrew implant resulted in a linear decrease in stress values in both the screw and bone models. Increases in length of miniscrew implant models showed slightly increased stress values in miniscrew and cortical bone models, but slightly decreased stress values in cancellous bone models. Incremental increases in loading forces from 50 to 400 g resulted in increasing stress values in all models, especially miniscrew implants with diameters of 1.0 and 1.2 mm. Moreover, miniscrew implants with diameters of 1.6 and 1.8 mm. showed lower stress values in all models. However, loading forces of 50 to 400 g did not result in excessive stress in either miniscrew implant or bone models. Biomechanically, recommended sizes of miniscrew implants should be 1.6 to 1.8 mm. in diameter and more than 4.0 mm. in length. Loading forces of 50 to 400 g were safe in all models.

Key words; diameter; finite element method; length; loading force; miniscre