COMPARATIVE STRESS DISTRIBUTION OF DIFFERENT IMPLANT DESIGNS IN BONE:

A 3-D FINITE ELEMENT ANALYSIS

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BRANCH I

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Abstract

Introduction

Development of an ideal substitute for missing teeth has been a major challenge of dental practitioner for millennia. An implant is a medical device which is made from one or more biomaterials, that are intentionally placed in the body either totally or that is partially buried beneath an epithelial surface. Many factors affect load transfer at the bone implant interface such as the type of loading, material properties of the implant and prosthesis, implant geometry, surface structure, implant design quality (diameter and length) and quantity of surrounding bone, and nature of bone implant interface. Insufficient vertical and horizontal bone volume does not allow implant placement particularly in the bone atrophy distal to the mental foramen. In this instance, small-diameter implants may be used where there is not enough bone width in the alveolar ridge; however, large-diameter implants have been proposed to increase the osseo integrated implant interface.

Here using a finite element analysis the stress distribution among four different implant designs were compared and the implant with the most favorable stress distribution in bone was found.

Aims and Objectives

The aims of the study are to compare the stress distribution of various implant designs in bone using a three dimensional finite element analysis.

The objective of the study is to compare stress distribution among long and short implants and also between cylindrical, tapered and hybrid implant
Abstract

designs. This is to determine which implant design is the most ideal one in
distributing stresses in the bone so that it will enhance the stability as well as
survival rate of the implant.

Methodology

A three dimensional finite element model of the mandible with four
different implant designs were modelled based on the measurements of a dried
human edentulous mandible using modelling software ‘Solidworks’ and was
analyzed for stresses produced in the bone following axial and non-axial biting
loads of different magnitude using ‘ANSYS Workbench’.

Results

The results of the study indicated that implants with wider diameter
have more favorable stress distribution in bone compared to longer implant
designs and influence of implant length and taper was not as pronounced as
that of implant diameter.

Summary and Conclusion

Based on the observations in this study, it was concluded that short
implants with wider diameter have more favorable stress distribution compared
to other implant designs and could be considered for use with fixed
restorations. However further clinical research is suggested in order to prove it
as a reliable and successful treatment modality