Experimentally induced abutment strains in three types of single-molar implant restorations

Wook-Jin Seong, DDS, MS,a Tom W.P. Korioth, B Od, Cir Dent, PhD,b and James S. Hodges, PhDc

School of Dentistry, University of Minnesota, Minneapolis, Minn.

Statement of problem. The choice of single-molar implant design is difficult because of a lack of controlled, quantitative biomechanical analyses.

Purpose. This study determined the effect of 3 single-molar implant designs on implant strains under a variety of homologous loading conditions.

Material and methods. On each implant abutment, 4 strain gauges were placed axially at 90 degrees to each other on the buccal, lingual, mesial, and distal surfaces. Effects of implant design, load location, direction, and magnitude were tested on axial and bending (buccolingual and mesiodistal) strains of 3 singlemolar implant designs: (1) single, 3.75-mm (regular) diameter implant, (2) single, 5-mm (wide) diameter implant, and (3) two 3.75-mm diameter (double) implants connected through a single-molar crown. Results were analyzed with ANOVA.

Results. Variations in loading conditions induced 3-dimensionally complex abutment strains on the tested implant designs. Peak absolute strains in mesiodistal direction were $6493 \sum$ for design 1 and $3958 \sum$ on design 2, and $3160 \sum$ in buccolingual direction on design 3. For all loading conditions, the single 3.75-mm diameter implant consistently experienced the largest strains compared with wide-diameter and double implant designs. Changes in centric contact location affected implant abutment strains differently among the 3 designs. Angulated force direction resulted in larger bending strains.

Conclusion. For single-molar implant designs, an increase in implant number and diameter may effectively reduce experimental implant abutment strains. (J Prosthet Dent 2000;84:318-26.)