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골조직의 조건과 임플란트 연결시스템 조건에 따른 유한요소법적 분석

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Finite element analysis according to the conditions of implant connection system and bone qualities surrounding implant

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조 선 대 학 교 대 학 원

치 의 학 과

김 상 영

골조직의 조건과 임플란트연결 시스템 조건에 따른 유한요소법적 분석

지도교수 김 병 옥

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치 의 학 과

김 상 영

김상영의 박사학위논문을 인준함

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조 선 대 학 교 대 학 원

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ABSTRACT

Finite element analysis according to the conditions of implant connection system and bone qualities surrounding implant

Kim Sang-young D.D.S. M.S.D.
Advisor: Prof. Kim Byung-ock, Ph.D.
Department of Dentistry,
Graduate School of Chosun University

The purpose of this study was to investigate the distribution of stress on the implant with internal connection type placed in the type IV regenerated bone adjacent to the native bones using three dimensional finite element stress analysis. Using EMRC NISA DISPLAY Ver. 12 program (IronCAD LLC, USA), a program was written to generate a model simulating a cylindrical block section of the mandible 20 ㎜ in height and 10 ㎜ in diameter.

Two screw type implant models, the external joint connection, and the 8° morse taper, internal joint connection, and double tapered body (5.0 ㎜ in width, 13 ㎜ in length, OSSTEM SS Ⅲ, Busan, KOREA), were modeled for this study, and was assumed to be 100% osseointegrated. The implant with external connection type placed in native bone was used as a control group. And it was restored with gold crown with resin filling at the central fossa area. The implant was surrounded by the

regenerated type IV bone, with 3.0 ㎜ in width and 7 ㎜ in length from the platform edge of implant. And the regenerated bone was surrounded by type I and type III of native bone, respectively. The present study used a fine grid model incorporating elements of 431,306 and nodal points of 81,046.

A load of 200N was applied at the 2 points on occlusal surfaces of the restoration, the central fossa (A point), and the functional cusp (B point), at a parallel direction to the vertical axis of the implant, respectively.

The stress values were calculated in implant-bone interface, and 3-㎜ away point from implant fixture for implant with internal connection type. The results were as follows:

1. The main tendencies of bone stress were identical both in the internal and external connection system model and in the native and regenerated bone model, such as higher stress concentration under vertical loading applied in the functional cusp than vertical loading applied in the cental fossa, and higher stress concentration in the type I bone quality than type III bone quality .

2. In case of the implant placed into native bone, the changes of the stress values along with side of implant fixture with internal or external connection type differed.

3. In the internal connection type, stress values in regenerated bone adjacent to native type III bone quality were sometimes higher than

those in regenerated bone adjacent to type I native bone.

4. In case of the internal connection type, stress values in point 3-mm away from implant-bone interface were higher than those in implant-bone interface at the apex of the regenerated bone.

Within the limitations of the results of this study, this study showed that the dynamic behavior of dental implant system is influenced by bone quality around the osseointegerated dental implant, connections between the implant and abutment, and loading points applied to implant prosthesis. The further research should be needed for the optimum design of dental implant to prevent bone resorption around the implant.