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Bone-implant interface around titanium implants under different loading conditions: a histomorphometrical analysis in the Macaca fascicularis monkey.

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Abstract

BACKGROUND: Bone healing around endosseous dental implants is associated with peri-implant loading conditions. Therefore, the aim of this study was to evaluate histomorphometrically the bone response around unloaded, delayed, and immediately loaded implants with a progressive thread design that were placed in the posterior regions of the lower jaw in monkeys.

METHODS: Nine adult monkeys (Macaca fascicularis) were used in this study. After extraction of the second premolars and first and second molars in the mandible, the bone was allowed to heal for a period of 3 months. Forty-eight 8 mm long implants with a diameter of 3.5 mm were placed according to the following protocol. In two of the monkeys, six implants were placed and left to heal submerged for 3 months (group A). In seven monkeys, 21 implants were placed in one side of the mandible and loaded after 3 months of submerged healing (group B). The group B implants were loaded with temporary resin bridges at the same time as another 21 implants that were loaded immediately (group C) after placement in the contralateral side of the mandibles of the same monkeys. The occlusion of group B and C implants was checked for optimal relationship of the resin bridges that were replaced 1 month later with metal bridges and loaded for an additional 2 months. The group A animals were sacrificed after 3 months of submerged healing without loading; group B and C animals were sacrificed after 3 months of implant loading. Specimens were examined histologically and histomorphometrically.

RESULTS: All implants osseointegrated without presenting any gap in the metal-bone interface. Compact cortical bone was found in contact with the implant surfaces. Group A implants demonstrated in the interface cancellous bone with loose connective tissue. Group B and C implants showed a thick cortical plate with extensive bone trabeculae formation. There was a significant difference in bone-to-implant contact (BIC) between the various loading conditions. No significant difference ($P < 0.05$) was found between groups B and C. There was an increased area of bone (BA) within the threads as well as around the apices of group B and C implants.

CONCLUSIONS: Implant loading might have stimulated increased bone formation and thus may be a key factor in influencing positive osseointegration. In addition, immediately loaded implants may osseointegrate in a similar manner as delayed loaded implants.

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