Expanded Structured Abstract

Comparison of External and Internal Hex Implants' Rotational Freedom: A Pilot Study

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Purpose: Loosening or fracturing of abutment or retaining screws is the main mechanical complication associated with single-tooth implants.[1] The bearing surface of an implant and of its opposing abutment form a screw joint that must remain stable throughout the restoration's life. To reduce the incidence of screw loosening, biomechanical parameters of movement at the interface of the implant-abutment complex must be studied.[2,3] Binon[4] reports that optimal joint stability requires rotational freedom of less than 5 degrees. The present study sought to evaluate and compare the rotational freedom of external and internal hex implants and their abutment counterparts to verify if a particular measuring device is suitable and if all components are in accordance with manufacturing specifications.

Materials and Methods: Five regular-diameter external hex implants and five regular-diameter internal hex implants with abutments (Conexao Sistemas de Proteses) were evaluated. To measure the rotational freedom, a device in which the implants were secured by a chuck to a table base with a degree scale was developed (Fig 1). The rotational freedom measuring device table was calibrated through geometric analysis of its scale and a calibrated protractor. A handle and needle pointer were fixed to the abutments through two opposing screw holes. Abutments were screwed to the implants using a manual torque wrench (20 Ncm). With a dynamometer, a 40-Ncm torque was applied to the abutment, and the difference between the clockwise and counterclockwise movement was recorded as rotational freedom with 0.5-degree accuracy. Measurements were taken in every possible position (three different positions, three times) and combination of implants and abutments.

An optical measurement system (RAM Optical Instrumentation) with Auto MAP X-Y-Z software (Measurement Analysis Program) was used to measure both implant and abutment hexagons with 0.0001-mm accuracy. Three measurements were taken per hexagon, corresponding to the distance of its opposing boundary lines. Data were subjected to analysis of variance ($P < .05$) to determine statistical significance between internal and external hex implants. Mean values and standard deviations were recorded.

Results: Mean rotational freedom was 5.5 ± 1.9 degrees for internal hex implants, which presented rotational freedom of between 3 and 5 degrees in 58.67% of the combinations; 41.33% showed rotational freedom higher than 5 degrees (recorded range 3.5 to 11.0 degrees). Mean rotational freedom was 2.9 ± 0.3 degrees for external hex implants. All external hex implant

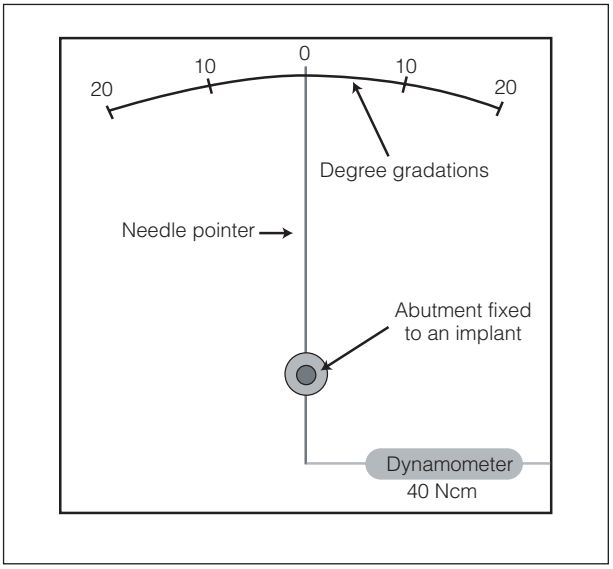

Fig 1 Device created to measure rotational freedom.

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configurations presented rotational freedom lower than 5 degrees; 93.33% showed rotational freedom lower than 3 degrees (recorded range 2.5 to 3.5 degrees). Statistically significant differences were found between groups ($P < .05$).

Conclusion: In this pilot study, internal hex implants presented more rotational freedom than external hex implants. All samples were in accordance with the manufacturing specifications. The reported measuring device appears suitable to analyze rotational freedom and will be used in further studies with other implant systems. The number of implants and abutments used in this pilot study is not large enough to draw more precise conclusions.

References

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Literature Abstract

Relation in color of three regions of vital human incisors

The aim of this clinical study was to evaluate the relation in color of three segments (cervical, middle, and incisal) of vital upper central incisors. Sixty-four right central incisors without caries, wear, or erosion, but allowing for small composites in the proximal surfaces, were measured for color with a digital camera. A head frame was used to stabilize the subjects for measurement and to improve repeatability. A digital camera with 1024 x 768 pixel resolution and a 24-bit RGB scale was used at a 35-degree angle to the teeth to reduce surface reflected light. The camera's external flash with attenuation grid constituted the diffuse illumination. The data was converted to CIE Lab values, and the means of the three segments were compared using repeated measures analysis of variance. Pearson correlation coefficients were used to quantitatively determine the relationship between the colors of the segments. Linear regression analysis was also conducted to describe the relation of CIE Lab values among the three segments. The mean color difference (Delta E) between the three segments ranged from 5.9 to 12.2, all above levels of visual perceptibility. CIE Lab values for the tooth segments all differed significantly from each other ($P < .001$). The correlation coefficients between the CIE Lab values of the three segments were statistically significant to each other. All predictions for the L^* and the b^* values were statistically significant, but lower correlation coefficients were found for the a^* values. Limitations include the lack of color accuracy evaluation of the measurement set up and the vague use of linear regression analysis without adjusting for possible confounders, eg, age and proximal restorations.

Dozic A, Kleverlaan CJ, Aartman IH, Feilzer AJ. *Dent Materials* 2004:20:832–838. **References:** 23.
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