Micro-Gap Analysis at the Implant-Abutment Interface of Various Dental Implant Systems

Prabhu Gubbi, Ph.D., Ross Towse, Zach Suttin
BIOMET 3i, Palm Beach Gardens, Florida, USA.

INTRODUCTION:
This microscopic study qualitatively and quantitatively evaluates the physical characteristics of the implant- abutment junctions (IAJs) of various industry leading implant systems (BIOMET 3i, Nobel Biocare, Straumann, and Demetron).

CLINICAL RELEVANCE:
The microgap present at the IAJs has clinical relevance due to the potential detrimental effects associated with an inferior seal. Specifically, it has been hypothesized that poorly sealed IAJs may permit bacterial contamination to and from the surrounding tissues. This study’s findings would serve as information and aid to potential local tissue loss.

MATERIALS AND METHODS:
The implant systems evaluated are included in Table 1. Representative implant systems were evaluated from each of the above mentioned manufacturers. For the purposes of this study, all implants were assembled with their respective abutments. Two (2) micrometers of gap were utilized using a calibrated block (0.5 mm Bunsen digital meter, Werth 3D Corporation, Brooklyn, NY). The assemblies were mounted in polymer resin, sectioned at the abutment-to-implant interface, and polished to a metallographic finish. The cross-sectioned implants were evaluated using scanning electron microscopy (0.5-6 mm magnifications, SEM, JEOL, Tokyo, Japan). The SEM images were utilized to qualitatively and quantitatively assess the physical characteristics of the microgap.

RESULTS:
Interface Design:
3i Microns T3 with DCD™ implant systems included a Tapered-Flat implant body. The 4.0 and 4.3 mm implant systems exhibited interface characteristics, each exhibiting an approximate 350 micrometer junction length.

Nobel Biocare NobelActive™ implant systems included a conical Taper with a slightly larger interface width. The 3.5 and 3.6 mm implant systems exhibited interface characteristics, each exhibiting an approximate 350 micrometer junction length.

The Nobel Biocare NobelActive™ implant system included a conical Taper with a slightly larger interface width. The 3.5 and 3.6 mm implant systems exhibited interface characteristics, each exhibiting an approximate 350 micrometer junction length.

The Straumann® Bone Level both demonstrated a high degree of variation in the width of the microgap when comparing the right and left sides of the connection. The Nobel Biocare NobelActive™ and BIOMET 3i with DCD™ connections did not display this variation.

Qualitative Observations of the Interface:
The Demetron, Astra Tech, OsseoSpeed™ and Osseospeed™ Bone Level both demonstrated a high degree of variation in the width of the microgap when comparing the right and left sides of the connection. The Nobel Biocare NobelActive™ and BIOMET 3i with DCD™ connections did not display this variation.

Quantitative Microscopy:
The microgap magnitude was measured using the analysis software (Image-Pro, Nikon, Tokyo, Japan). The results are presented in the Table 2. TheStraumann® Bone Level both demonstrated a high degree of variation in the width of the microgap when comparing the right and left sides of the connection. The Nobel Biocare NobelActive™ and BIOMET 3i with DCD™ connections did not display this variation.

Table 2. Implant Systems Studied

<table>
<thead>
<tr>
<th>Implant System</th>
<th>Right Outer</th>
<th>Left Outer</th>
<th>Right Inner</th>
<th>Left Inner</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nobel Biocare NobelActive™ T3TM with DCD™</td>
<td>4.0 x 12 mm</td>
<td>4.0 x 12 mm</td>
<td>4.0 x 12 mm</td>
<td>4.0 x 12 mm</td>
</tr>
<tr>
<td>Dentsply Astra Tech™ OsseoSpeed™ T3™</td>
<td>4.1 x 15 mm</td>
<td>4.1 x 15 mm</td>
<td>4.1 x 15 mm</td>
<td>4.1 x 15 mm</td>
</tr>
</tbody>
</table>

REFERENCES: