Digital Workflow Used to Fabricate Implant-Supported Three-Unit Fixed Dental Prosthesis

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Background

The use of chair-side oral scanning for multi-unit implant prostheses is still limited, even though an increasing number of dentists are incorporating computer aided design and manufacturing (CAD/CAM) in everyday practice, and the potential for saving precious time and money is enormous. There are coded healing abutments available that allow for intra-oral scanning and a digital prosthetic workflow without first replacing the healing abutments by scanning abutments.

Aim/Hypothesis

By conducting a study on CAD/CAM 3-unit prostheses, the current state of the digital workflow and the accompanying pitfalls and possibilities are explored, with the expectation that the use of an oral scanner would allow for the fabrication of abutments and bridges with good clinical results.

Material and Methods

In an IRB approved prospective trial, in healthy patients two dental implants (4mm width, length 8.5-15mm) were inserted to replace three missing posterior teeth. After osseointegration, a coded healing abutment was placed, and subsequently full-arch intra-oral scans were made to produce patient specific titanium abutments and a full-zirconia bridge. Clinical variables were measured before treatment, after loading and at one year after loading. Radiographic bone height was measured on radiographs of time of loading and one year after. Patient satisfaction was measured using questionnaires, complications were noted.

Results

All patients (n=60, mean age 60.8 years [35.7-78.1], 30m/30f) were treated with CAD/CAM abutments and bridges (n=60, 33 maxilla, 27 mandibula); average follow-up was 13 months (range 1-35). One implant was lost before loading. At 1-year (n=28), average radiographic bone loss was 0.04mm and no significant changes in plaque, bleeding, probing pocket depth or gingiva index occurred. Loosening (n=3) and periimplant mucositis (n=2) could be treated. Some scans had to be redone (n=7) and many bridges were rejected (n=20) before delivery because the color did not match. After test-fitting, adjustment of color (n=2), design (n=2) or occlusion (n=2) was performed. Slight adjustment of contact, occlusion or articulation was common (n=35) at cementation. The dentists involved, reported slight color mismatch (43%) and detectable margin discrepancy (5%). Patients were highly satisfied with design (4.3/5), color (4.2/5) and overall treatment result (4.9/10 before, 8.1/10 after treatment).

Conclusion and Clinical implications

The application of CAD/CAM showed promising results with good clinical results and high patient satisfaction, but the high number of rejections and adjustments would need to be addressed. The shortcomings we encountered in this workflow were mainly due to the laboratory procedures and the restorative materials used. After both the dentist and the dental lab have gained sufficient experience with the digital workflow, it becomes a feasible alternative to the conventional impression workflow.

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