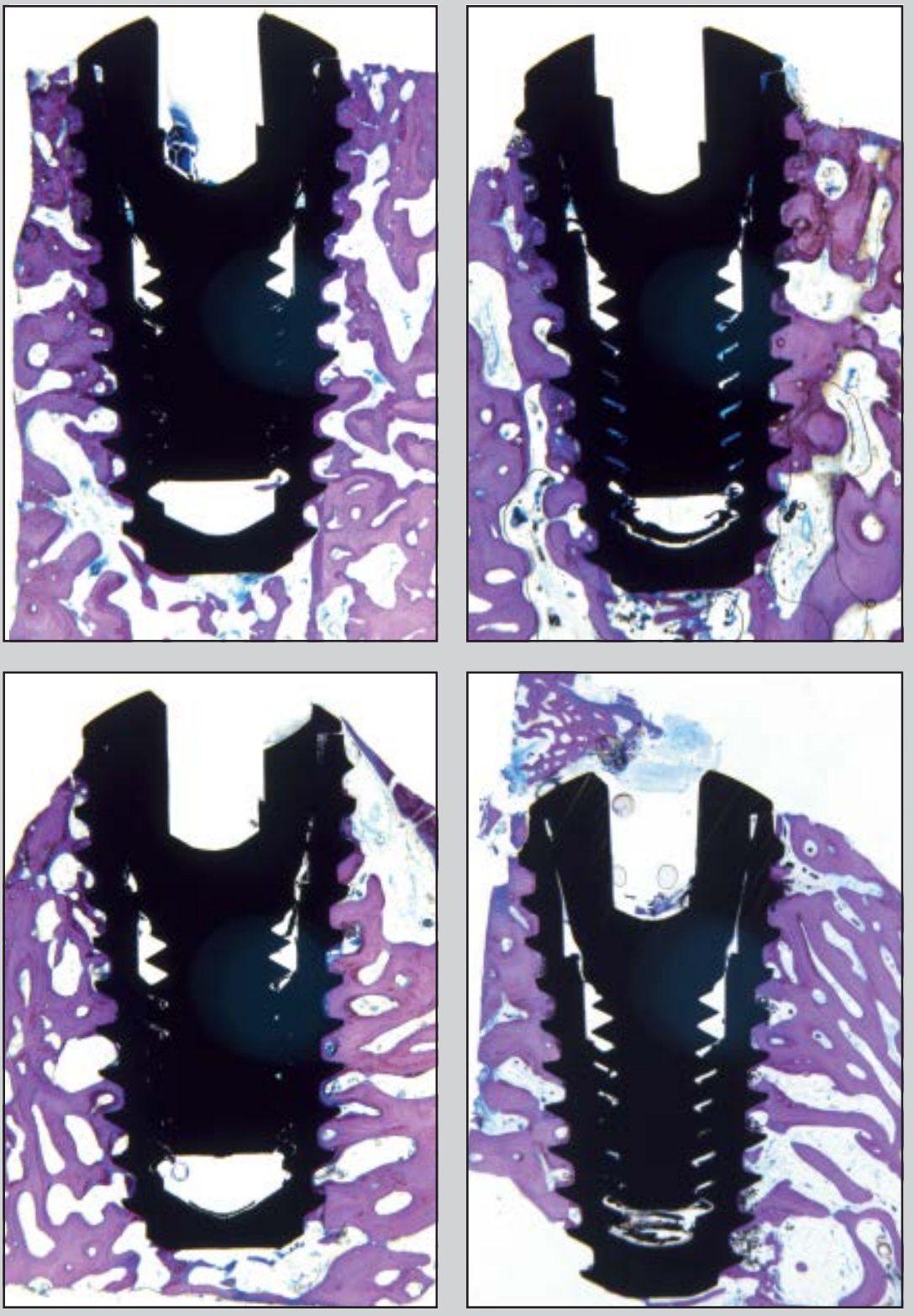
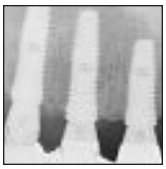


Clinical and Histologic Evaluations of SLA Dental Implants



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The goal of this investigation was to evaluate the efficacy of dental implants with a surface that was sandblasted with large grit and acid etched in a human model. Eight patients volunteered to allow the biopsy of a small implant in exchange for complete dental rehabilitation at no cost. All biopsy sites received soft and hard tissue reconstruction, and this report provides observation of successful bone-to-implant contact and successful prosthesis construction for the patient. The patients enthusiastically reported improved quality of life as a result of participation in this study. The surgeons' confidence in this implant was reflected by the clinical and histologic result of the study. Int J Periodontics Restorative Dent 2017;37:175–181. doi: 10.11607/prd.3131

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Dental treatment to replace missing teeth for both edentulous and partially dentate patients routinely involves the use of dental implants to achieve functional mastication, esthetics, and phonetics. The implant industry continues to reevaluate design and surface features in the quest for an optimal product. The possible surface treatments include titanium plasma spraying, acid etching, hydroxyapatite coating, laser ablation, and sandblasting with soluble particles. The goal is to improve the rate and stability of osseointegration as measured by bone-to-implant contact. Studies have shown that the implant surface topography can affect both osteoblast gene expression and differentiation of progenitor cells into osteoblasts.[1,2]

A surface that has been sandblasted with large grit and acid etched (SLA) has been proven effective in both preclinical and clinical studies conducted by other investigators.[3–7] For example, Buser et al reported a 10-year implant survival rate of 98.8% and a success rate of 97.0% for SLA surface dental implants.[3] In addition, the prevalence of peri-implantitis was low, at 1.8% during the 10-year period. Another 10-year study by Rocuzzo et al reported survival rates of 90% to 96.6% for 101 periodontally compromised and periodontally healthy patients.[8]

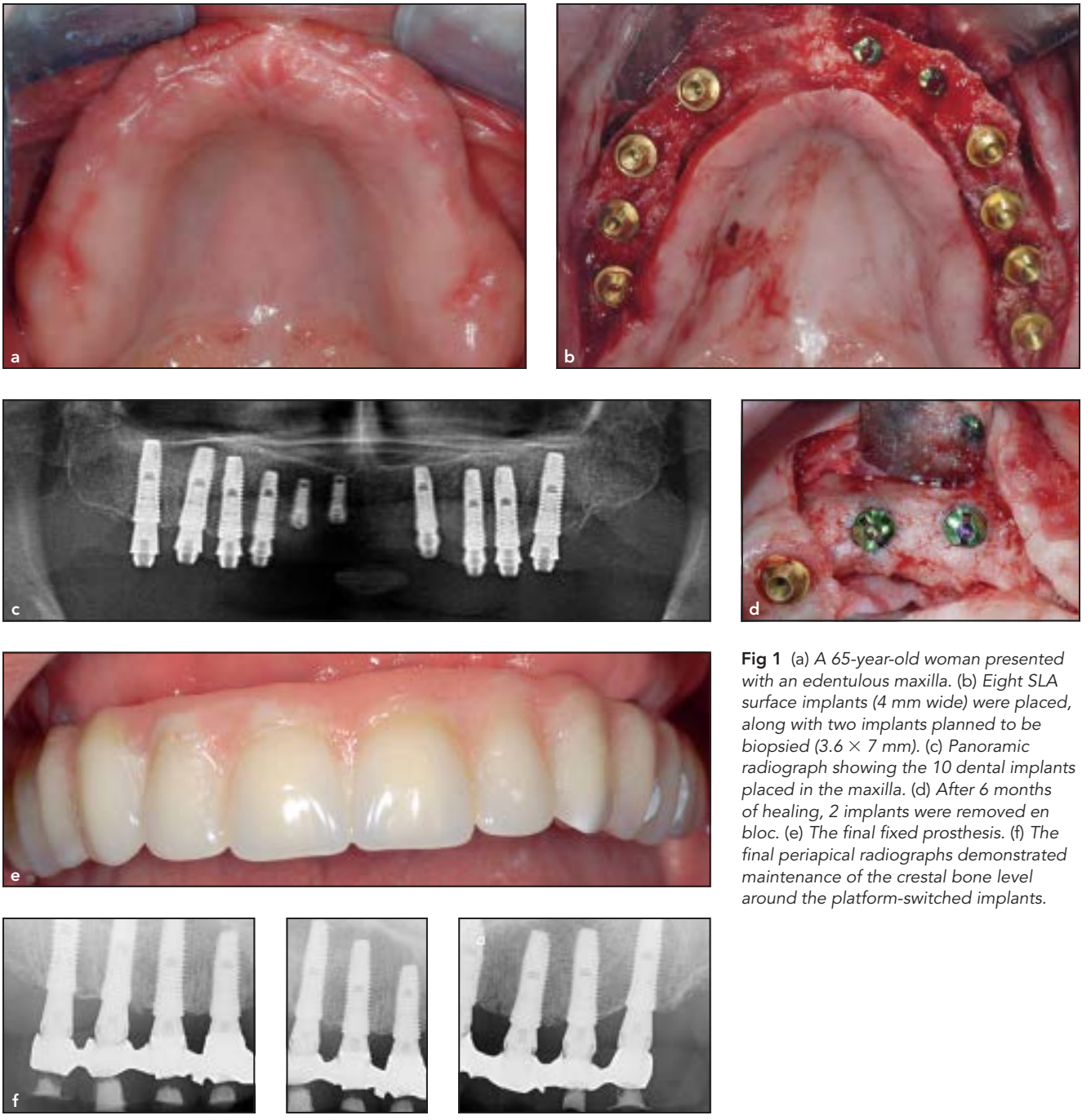
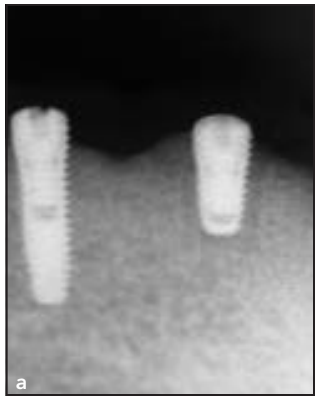
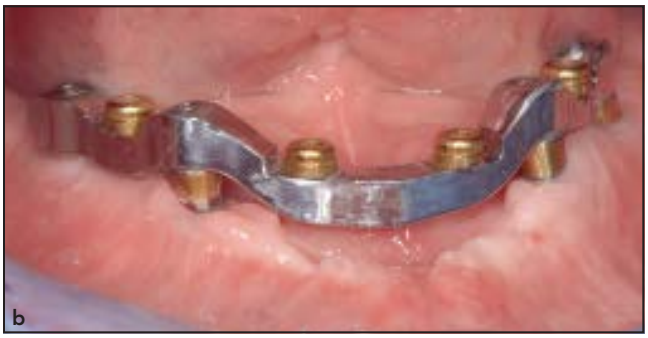


Fig 1 (a) *A 65-year-old woman presented with an edentulous maxilla.* (b) *Eight SLA surface implants (4 mm wide) were placed, along with two implants planned to be biopsied (3.6 × 7 mm).* (c) *Panoramic radiograph showing the 10 dental implants placed in the maxilla.* (d) *After 6 months of healing, 2 implants were removed en bloc.* (e) *The final fixed prosthesis.* (f) *The final periapical radiographs demonstrated maintenance of the crestal bone level around the platform-switched implants.*

Human histologic evidence of successfully osseointegrated implants is extremely rare in the literature because there are not many opportunities to retrieve implants in humans.[9–14] This research provided an opportunity for individuals requiring dental implants to receive surgical and prosthetic treatment at no cost in exchange for retrieval of one dental implant. Quality of life dramatically improved for these patients. The SLA surface implants (Dentium) investigated in this research come with a double-threaded tapered body design, an internal conical connection, a platform-switch design, and a cutting flat end.





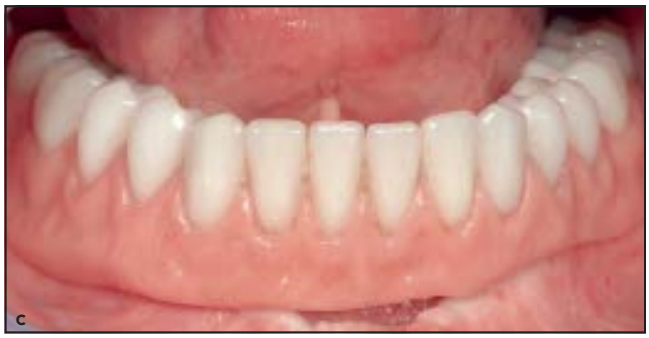


Fig 2 (a) *A 60-year-old man received four 4-mm-wide implants and two 3.6 × 7-mm implants planned for retrieval.* (b) *A milled bar was fabricated over four implants.* (c) *The final removable prosthesis.*

The retrieval of histologic samples from successfully osseointegrated implants is an accurate and irrefutable confirmatory methodology to generate valuable knowledge regarding the bone-to-implant contact and thus the predictability of the product.[15]

Materials and Methods

Implant Surgery

The objective of this proposed study was to provide a short-term observation of dental implants placed into localized or completely edentulous ridges. The goal was to evaluate the bone-to-implant contact of implants placed in humans to demonstrate the efficacy of their design and surface finish. Eight patients were enrolled and agreed to sign an informed consent form based on the Helsinki Declaration of 1975, as revised in 2000. The study was approved by the institutional review board of Regina Maria Hospital in Bucharest, Romania.

Pre- and postsurgical clinical examinations were performed in concert with an evaluation of oral hygiene during each patient visit. All implant (SuperLine, Dentium) surgeries were performed as suggested by the manufacturer under local anesthesia and sterile conditions (Figs 1 to 3). All implants were allowed to heal in submerged condition. There were no adverse events in the patients who kept planned appointments for observation. Periapical radiographs were made at the 6-month surgical visit.

Second-stage Surgery and Biopsy

All second-stage procedures were performed 6 months after implant placement. All procedures performed in this study were routine, with the exception of an en bloc removal of one implant from each patient. The biopsied implants were 7 mm in length and 3.6 mm in width. They were immediately immersed in a fixative solution.

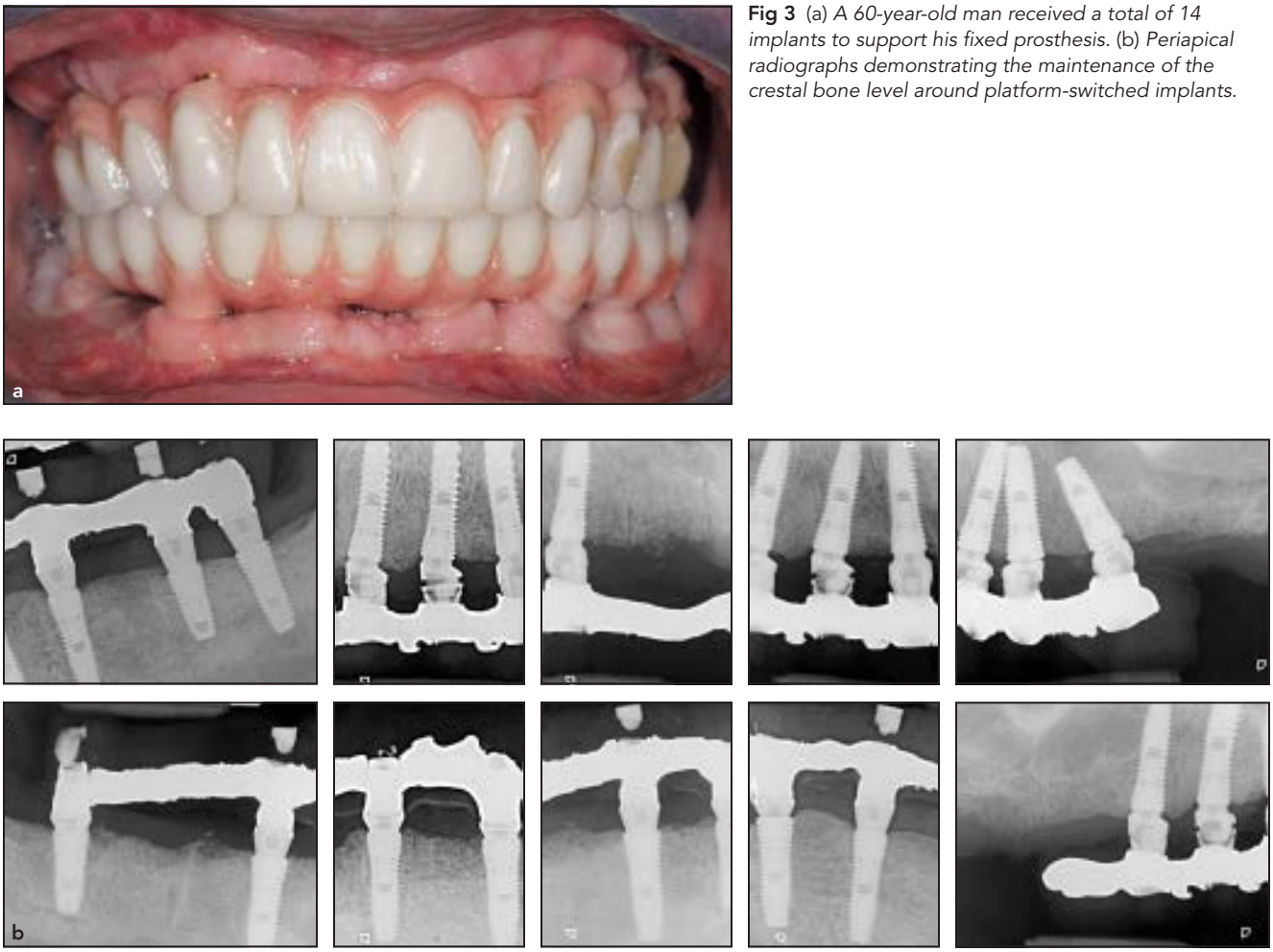


Fig 3 (a) *A 60-year-old man received a total of 14 implants to support his fixed prosthesis.* (b) *Periapical radiographs demonstrating the maintenance of the crestal bone level around platform-switched implants.*

Histologic and Histomorphometric Analyses

Fixed samples were dehydrated in a graded series of ethanol (60%, 80%, 96%, and absolute ethanol) using a dehydration system with agitation and vacuum. The blocks were infiltrated with Kulzer Technovit 7200 VLC-resin. Infiltrated specimens were placed into embedding molds, and polymerization was performed under blue and white light. Polymerized blocks were sectioned in a mesiodistal direction and parallel to the long axis of each implant. The slices were reduced by microgrinding and polishing using an Exakt grinding unit to an even thickness of 30 to 40 µm. Sections were stained with rapid bone stain and counterstained with acid fuchsin and examined using both a Leica MZ16 stereomicroscope and a Leica 6000DRB light microscope. Histomorphometric measurements were performed using ImageAccess software (Imagic) to calculate the percentage of mineralized bone, soft tissue components (connective tissue and/or bone marrow), and residual graft particles along the bone-implant contact surface.

Results

Clinical and Radiographic Observations

All implants were successfully placed and achieved clinical osseointegration with no signs of adverse events. A total of 46 implants were placed in 8 patients, and 8 implants were biopsied for evaluation. All reconstruction areas healed uneventfully.

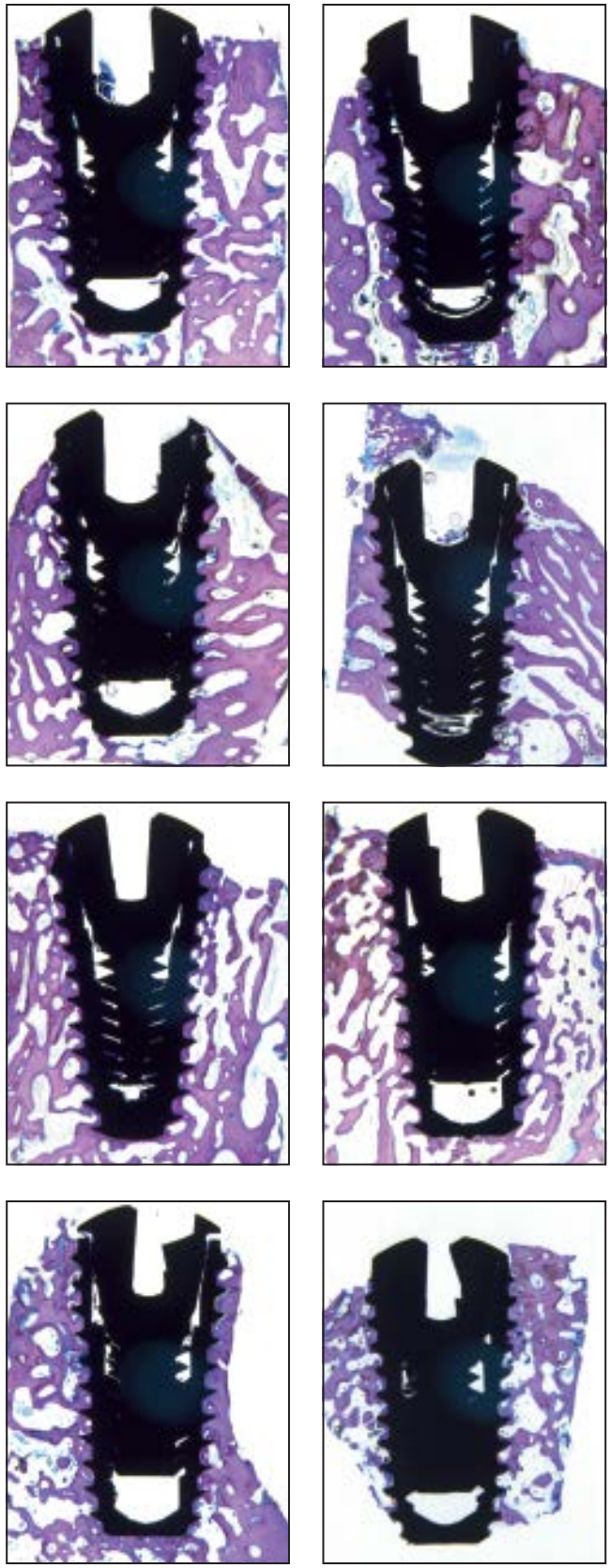


Fig 4 *All histologic specimens demonstrated significant bone-to-implant contact. Newly formed dense bone was found in contact with the implant surfaces with normal bone marrow spaces and blood vessels. The crestal bone was superior to the thread in each specimen.*

Radiographic evaluation demonstrated excellent maintenance of crestal bone level around dental implants. Each patient was prosthetically reconstructed with significant improvement in quality of life verbally expressed by the patient.

Histologic Observations

All histologic specimens demonstrated significant bone-to-implant contact (Fig 4). Newly formed dense bone was found in contact with the implant surfaces with normal bone marrow spaces and blood vessels. The crestal bone was superior to the thread in each specimen.

Histomorphometric Analysis

Light microscopy revealed excellent bone-to-implant contact (BIC) in all groups. The mean BIC was 74.5% for all 8 implants, ranging from 67.05% to 81.35%.

Discussion

Every patient is concerned about the long-term success of an implant therapy before engaging the treatment plan. The patient inevitably asks for the surgeon's prognosis, and no other evidence is more convincing than human histology. It is no secret that there is paucity in the availability of such information.

A number of successful university and hospital-based treatment center studies have been published with Dentium's SLA surface implants.[16–24] The present research group previously conducted a preclinical study on Dentium's SLA surface implants placed into regenerated bone.[25] This preclinical trial provided clinical and histologic evidence to support the efficacy of all three formulations of biphasic calcium phosphate to treat large alveolar ridge defects to receive osseointegrated dental implants.

The bone-to-implant contact observed histologically in the current study was remarkably strong. The histologic results of the investigation are included in this report and empower the surgeons' enthusiasm of the result when questioned by the patient.

The limitation of this study is that the biopsy specimens were not prosthetically loaded. Nonetheless, adjacent loaded implants have not experienced crestal bone loss and demonstrated their power to support prostheses. Every effort was made to use fixed prostheses, but two patients made the decision to have removable prostheses.

Conclusions

The results of this human histologic investigation confirm the osseointegration of the SLA surface implants in patients. All specimens demonstrated robust bone-to-implant contact. All patients reported improved quality of life as a result of participation in this study.

Acknowledgments

The authors reported no conflicts of interest related to this study.

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