

CASE REPORT

Bony spicules trapped in peri-implant soft tissue: a common unrecognized finding

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Introduction

Dental implant is currently considered a treatment of preference for patients whose tooth have been missing and want to have replacements that imitate natural teeth. The structure of peri-implant tissue is similar to that of teeth, but the major difference is the attachment of connective tissue fibers, which is much weaker and prone to be infected than natural teeth [1, 2]. Moreover, to restore teeth in cosmetic area, several factors are to be considered. One factor that affects both function and esthetic demand of implant restoration is the abutment materials, which will affect different tissue reaction and color perception through gingival tissue [3–6]. By investigating the effect of the types of abutment materials on the attachment formation and inflammatory response of the peri-implant soft tissue in human subjects, the authors have observed an

Key Clinical Message

According to the study, there were unexpected tiny bone spicules being inspected in peri-implant soft tissue. These displaced autogenous bone chips were probably presented when preparing implant sites. The displaced bone spicules seemed not induced significant inflammatory reactions; on contrary, defects of specimens and dissolving bone spicules pictures were demonstrated.

Keywords

Autogenous bone, bone spicules, Bone–Implant Interface, dental implant, dental implant abutment, peri-implant tissue, soft tissue response.

unrecognized finding of tiny bony spicules scattered in the peri-implant soft tissue. The numbers, characters as well as incidences of these bony particles were determined to speculate the nature and impacts of their presence.

Material and Methods

This article was a by study of the clinical research entitled Histological evaluation and inflammatory response of different abutment materials: An experimental study in human, which had been approved by the Ethics Committee of Faculty of Dentistry of Chulalongkorn University (HREC-DCU 2014-051). Patients who have posterior edentulous site with adequate bone for placing implant without bone grafting procedures and agreed to participate in the study were included in this study. The exclusion criteria included patients who were smokers, had

systemic diseases requiring routine use of antibiotics, or those who were pregnant. All patients included were agreed to participate in this study, with their signatures on the consent forms.

All implants fixtures used in the research were Aster tech OsseoSpeed™ implant (Dentsply, Mölndal, Sweden) with diameters of 4.5 and 5.0, length 9 mm and 11 mm, were placed by post graduate students under a supervision of one experience surgeon. All implants were placed at posterior edentulous sites with a standard implant surgical protocol according to the manufacturer's instruction. Briefly, patients were local anesthetized and, then, crestal incision line was performed. Flap operation followed by drilling protocol was performed at the implant sites. Then, the implant fixtures were installed. Participants were randomly assigned to the abutment groups. Three different abutment types, titanium, zirconia, and gold alloy were used and randomly allocated to patients after implant fixtures were installed to blind operators.

The biopsy procedure was taken at 8 weeks after implant installation. One operator performed the biopsy procedure using surgical blade no. 12D and 15C. The blade angle was parallel to the abutment surface, and the cutting blade was placed 1 mm away from abutment surface, which resulted in a circular shape of biopsy tissue. Then, the abutment and peri-implant tissue attached to the abutment were carefully removed. Regular healing abutments were inserted on the implant fixtures. After tissue biopsy obtained at 8 weeks, the sample had been processed for histological observations. Two tissue preparations techniques were operated as described below.

Resin embedding technique

The technique was previously introduced [7] and had been used to observe peri-implant tissue in many studies [8–10], which aimed to preserve the tissue–implant interface. Briefly, biopsy specimen underwent serial dehydration procedures with various concentrations of ethyl alcohol and then immersed with resin (Technovit 7200 VLC; Heraeus Kulzer, Wehrheim, Germany). The harvested specimen was positioned in a plastic block, filled up with resin (Technovit 7200 VLC; Heraeus Kulzer), and light cured (Exakt 520 Light Polymerization Unit, Norderstedt, Germany) for 12 h. The resin block was mounted on plastic slides. Then, the block was cut and grinded with Exakt cutting and grinding machines (Exakt Apparatebau, Norderstedt, Germany).

Paraffin embedding technique

After being fixed in 10% formalin overnight, the outer surface of tissue samples was marked with blue ink (CDI's

Tissue Marking Dyes®; Cancer Diagnostics, Durham, NC, USA). Then, specimens were cut into four pieces parallel to long axis of abutment, and the tissue parts were removed from abutment for processing. A routine histological processing technique was employed. Tissue sections were dehydrated in graded ethanol series (70–100%) and xylene and embedded in paraffin (Tissue Processing Center TPC 15 Duo/Trio; Medite GmbH, Wollenweberstr, Germany). The histological sections were cut with microtome (Leica RM2235; Leica Biosystems, Richmond, IL, USA) and adhered to a glass slide.

All sections were stained with hematoxylin and eosin (Leica Biosystems) and observed under light microscope (Olympus BX53, Tokyo, Japan).

Results

A total of 12 healthy patients, six males and six females, age 37–60, enrolled in this study. Patients who had edentulous areas on both sides were treated with two implants, and a total of 18 implants were placed. Three 4.5-diameter implants were placed in the second premolars, and 15 5.0-diameter implants were placed in the first and second molar areas.

Of the 18 studied samples, 15 were processed by resin embedded technique, and three cases were paraffin embedded. The slides processed by resin embedded technique presented tissue with metal abutments, while the slides from paraffin embedded revealed only peri-implant tissue. The occurrences of bony spicules were found in 13 of 18 cases (72.2%). Three cases elicited more than 15 pieces of bone were seen in histological slides (Fig. 1). Most cases (10 of 13) disclosed 1–2 bony chips per section (Figs. 2 and 3).

From both embedded techniques, the histological slides revealed fibrous connective tissue aligned around pieces of bones with mild degree of inflammatory cell presented. In some specimens, giant cells presented near the small pieces of bones, showing some irregularity of osseous surface (Figs. 1 and 2). In larger pieces of bone spicule, osteocytes could be seen. The location of displaced bony spicules was found at inner connective tissue part. Distances varied from 200 to 1000 micron away from subepithelium.

Mild-to-moderate inflammation was mostly observed at subepithelial area, with different degrees among abutment materials. The infiltrated areas were separated from bony chips by the alignment of fibrous connective tissue around bony tissue. Therefore, no relationships of bone spicules to inflammatory responses resulted from abutment materials were found (Figs. 1–3).

Follow-up of all patients, after tissue biopsy and 3 months after delivery of final crowns, was uneventful.

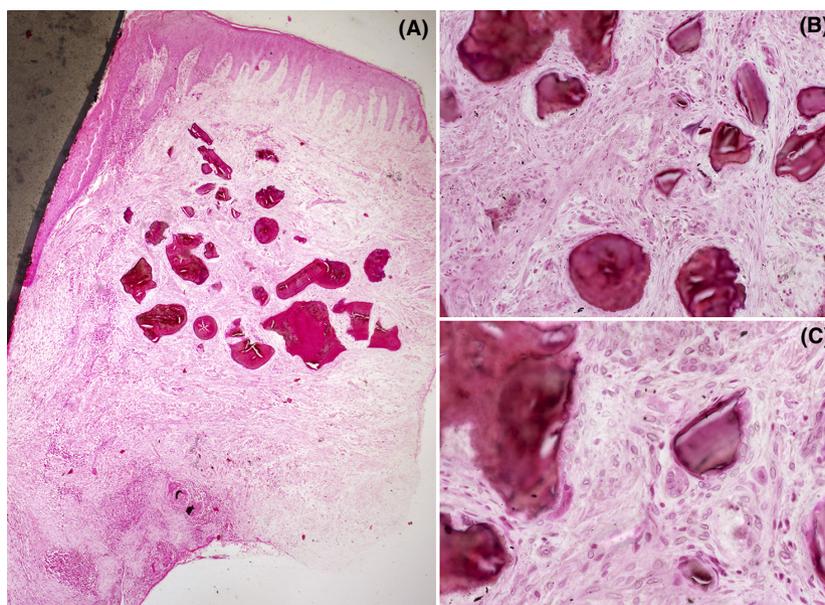


Figure 1. Representative histological section of peri-implant tissue attached to zirconia abutment processed by resin embedding technique (A) many bone spicules presented in the connective tissue part, magnification of 40× (B) fibrous connective tissue orientated around bony spicules with very mild inflammatory cells presented, magnification of 100× (C) giant cells presented along lower boarder of a small osseous surface, magnification of 400×.

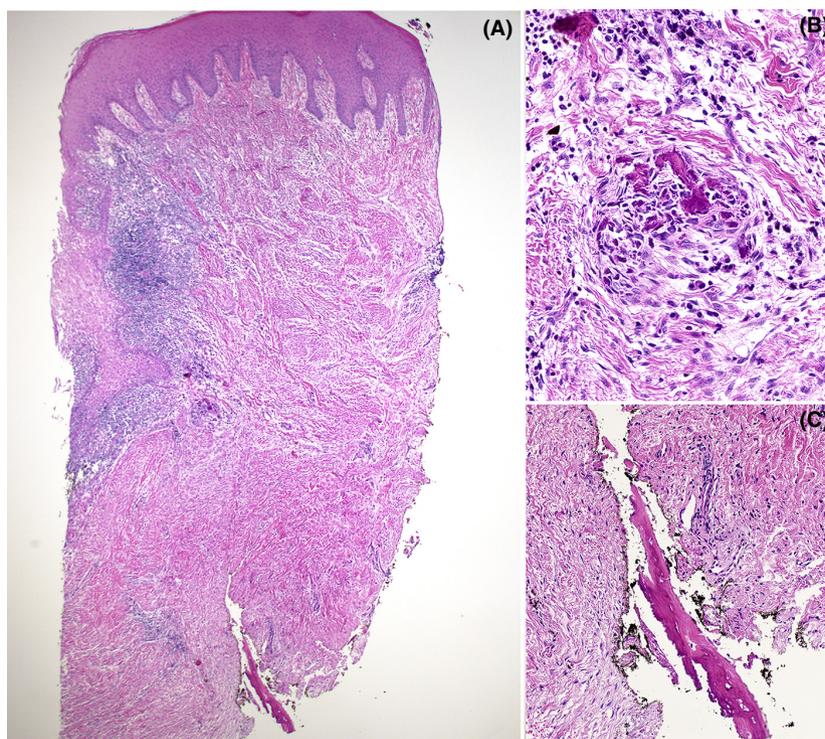


Figure 2. Representative histological section of peri-implant tissue from gold alloy abutment processed by paraffin embedding technique (A) groups of small pieces of bone spicules presented in the connective tissue part near inflammatory infiltrated area at subepithelium, magnification of 40× (B) fibrous connective tissue orientated around bony spicules with inflammatory cells and giant cells presented, magnification of 400× (C) large piece of bony chip presented at lower boarder of biopsy tissue, magnification of 100×

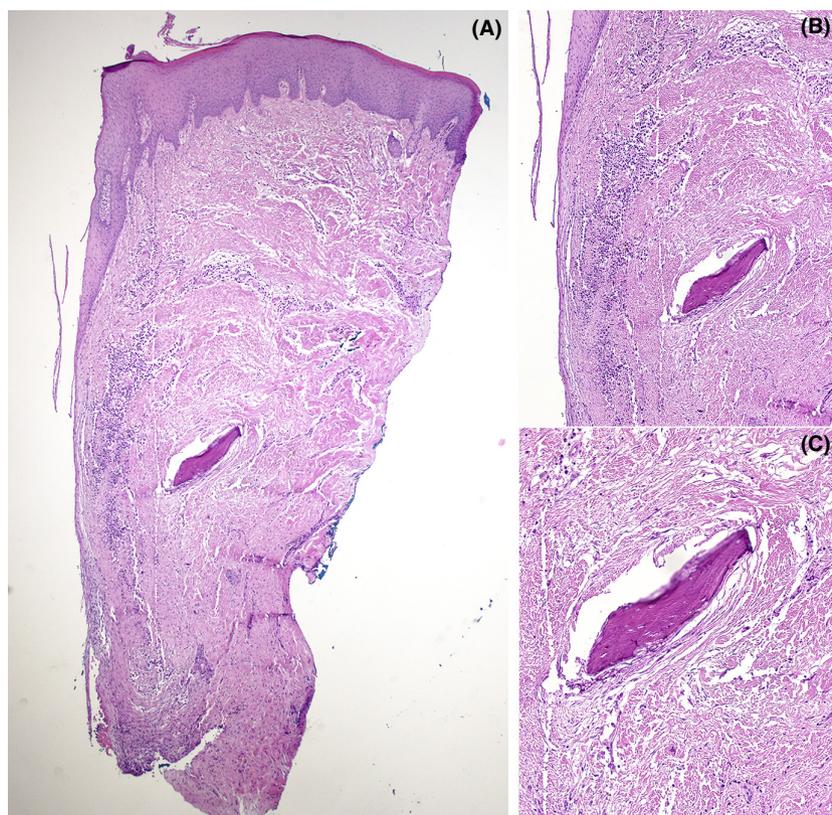


Figure 3. Representative histological section of peri-implant tissue from titanium abutment processed by paraffin embedding technique (A, B) a piece of bone spicule presented at the center of connective tissue part separate from the area of mild degree of inflammatory infiltrated zone, magnification of 40 \times and 100 \times (C) a piece of bony chip presented with large gap area, resulted from distortion in histological process of cutting through bony area, magnification of 200 \times

No gingival inflammation or others complications were reported.

Discussion

Bony particles deposited in dental peri-implant soft tissue had not been previously described. The reason might be that no histological evaluation was routinely required. The authors had an opportunity to look at the tissue formed around implant abutments after 8 weeks of installment for the clinical research. This by study finding of bony particles was likely to be from displacement of the bony debris when drilling the bone in order to prepare implant sites. In three cases, which many pieces of bone spicules were found, the operators might use the autogenous bone debris collected with drilling burs to place at buccal site of implant fixtures to correct very minor bone dehiscence occurred at buccal site. However, no guided bone regeneration procedures were recorded in all cases.

The supporting evidences were common observations in 72.2% of the cases presented bony spicules in the connective tissue part. It seemed that during healing process,

epithelial migration toward implant abutment materials and the spicules of bone was entrapped by connective tissue fibers. In three cases, many spicules presented and tissue reaction occurred toward the bones with some degrees of inflammatory cells and giant cells. However, some cases presented only fiber orientation toward this bone without inflammatory cells. Therefore, differential diagnosis of bony metaplasia was excluded.

Not many dental implant researchers studied on the peri-implant tissue were performed in human models. And to the author knowledge, these findings have not been mentioned before in the previous studies.

Previous studies related to autogenous particulate bone reported that the size of autogenous particulate bone affected the amount of new bone formation around the defect walls of periodontal tissue. Small sizes from 300 to 500 microns were found to be effective in restoring periodontal defect [11]. Various instruments were reported for the uses of harvesting particulate bones. High or slow speed handpieces, chisels, bone mills, piezosurgical instruments, rongeurs, or bone scrapers may be used to harvest bone from

donor sites [12, 13]. The previous studies suggested that harvesting autogeneous bone using bone mill and bone scraper techniques contains more viable cells and resulted in better osteoblastic cells adhesion and function [14]. In contrast, clinical evidence in animal models did not review significances of bone healing when using difference bone harvesting methods, between using bone mill, bone scraper, piezo drill, and bone slurry collected from drilling [15].

Moreover, to treat bone defect size, researcher suggested using resorbable or nonresorbable membrane to separate the healing of bone from soft tissue [16, 17]. This study could possibly explain the situation of using particulate bone graft without membrane and that some bone chips displaced to the soft tissue area.

As the presented bone spicules in soft tissue have not been studied, their clinical impact was not well established. Although severe inflammatory response was not found along with the bone chips, histological slides reviewed that bone chips were not likely to survive, due to limited blood supply. These bones were displaced from bone beds, and few vascular tissues were presented in connective tissue part¹. It seemed that pieces of bone in connective tissue would be dissolved over time. However, their impact on the harvesting technique was possible. Blade may hit the bony substance. Therefore, tissue preparation was affected resulting in tissue distortion.

Conclusion

Bony spicules could be displaced from bone bed to peri-implant tissue when preparing implant sites. At 8 weeks healing period, these bone spicules could be detected with some degree of tissue responses. As this finding has not been recognized, further studies should be conducted to investigate the impact of these bony spicules.

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Authorship

TS: collected and analyzed data, drafted the article, made critical review of the article. PS: designed the concept, made critical review of the article, approved the article.

PS: interpreted and analyzed data, drafted the article, made critical review of the article. AP: interpreted and analyzed data, drafted the article, made critical review of the article, approved the article.

Conflict of interest

All authors declare no conflict of interest.

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