Implant Fixture Fracture: Clinical Case Report

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I. Introduction

A dental implant has been used successfully to treat edentulous and partially edentulous patients for more than 30 years. Nowadays, it becomes more popular and considered as one of daily practice. For more successful treatment it is important to study about its complications. As mechanical complication there are loosening of abutment/gold screw, fracture of screw, super-structure failure and fixture fracture. Among them fixture fracture was reported as about 1~2% and most of them were distal end fixtures. In this case report the fractured fixture was anterior one of the splinted implants. This presentation deals with its re-treatment procedure and discusses its problems.

II. Case Report

5 years ago this patient (43 years old, Male) referred to Department of Prosthodontics at Dankook Dental Hospital for restoration of posterior mandibular region. He lost his mandibular molars with periodontitis (Fig. 1). Panoramic radiographic view was taken with radiographic stent and traced (Fig. 2). 2 fixtures were planned and installed (#46 ø 4.0 X 13.0, #47 ø 4.0 X 11.5 Osseotite®, 3i implant Innovations inc., Florida, USA) (Fig. 3, a). After 4 month the implants were uncovered. All implants were successfully osseointegrated and definitive implant-supported screw-type splinted crowns were fabricated and placed (Fig. 3, b).

16 month later, abutment screw of second molar was fractured. The screw was removed and new screw was torqued at 20 Ncm with torque controller. But after this, screw loosening was repeated and eventually fracture happened. 2 years later the patient complained that “bridge is mobile.” The fixture of #46 and the abutment screw of #47 were fractured (Fig. 4, a, b). Remaining fragment was removed and healing abutment was joined. Fractured fixture was removed with trepan drill (Fig. 5) and wide diameter implant (ø 6.0x13.0mm, Osseotite®, 3i) was placed immediately. Remaining defect site was filled with mixture of anorganic porous bovine-derived bone mineral (Biooss®, Geistlich Pharma, Wolhusen, Switzerland) and PRP and then sutured (Fig. 6).

III. Fractured Implant and abutment screws

Retrieved part of fractured fixture and abutment screw (Fig. 7) were observed under SEM (S3000H, Hitachi, Tokyo, Japan). SEM observation revealed extensive deformation of abutment screw threads (Fig. 8). On fixture, there was another crack line observed (Fig. 9.) At outer part of fractured surface and inner surface shows different particle features (Fig. 8, I-m, Fig. 9, d-h).

IV. Discussion

Reported frequency of fixture fracture is less than 2 %. It is not a big portion of total complication but critical. To prevent this, wide diameter implant or additional implant placement is recommended. A possible reason of fixture fracture in this case would be a repeated screw loosening of # 47. It makes stress concentrated on #46 and then strain overcomes the fatigue fracture strength. The fractured surface of implant was examined with SEM. It showed another crack line and various features of fractured surface. Yokoyama et al described the possible fracture mechanism of implant. They also mentioned multiple crack line and different surface characteristics of fractured surface according to the direction of repeated loads.

REFERENCES

Figures

Fig. 1. Radiograph of first visit

Fig. 2. Radiograph with radiographic stent.

Fig. 3. Radiograph after 1st surgery (a), after prosthesis placed (b).

Fig. 4. Removed prosthesis (a), Radiograph shows typical cupping pattern (b).
Fig. 5. Removed fixture.

Fig. 6. Radiograph after new fixture placement (a). after new prosthesis placed (b).

Fig. 7. Retrieved prosthesis and fixture

Fig. 8. SEM observation of abutment screw (a). Threads of tensioned side (b). 1st thread (c), 2nd thread (d), 3rd thread (e). Opposite side (f–h). Crack line develops through valley of thread (h). Fractured surface (i). Feature of shear crack (j). Metal surface shows the feature of crack line developed. This shows excessive force had torn off the thread (k). Feature outer part (l, m), inner part (n).
Fig. 9. SEM observation of fixture. Arrow shows another crack line (a). High resolution view of crack line. It shows the feature of metal surface where the crack starts (b). Same side of fractured surface. it shows similar metal surface with inside of upper crack line (c). Fractured surface and its various appearance (e–h). (g) shows ductile fracture features and In (h) outer part shows fine grain structures.
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임프란트를 이용한 치료가 장기간의 성공을 보고하고 있으나 좀 더 성공적인 치료를 위해서는 실패의 경우에 대한 분석이 필요하다. 하악 구치부에서 임프란트가 파절된 증례로 구치부 최후방 치아를 포함한 임프란트 치료시 최후방 임프란트가 파절되는 경우를 보고가 주로 있어왔으나 본 증례에서는 전방부의 임프란트가 파절되었다. 파절 원인으로는 후방의 임프란트에서 반복적인 나사 풀림이 발생하면서 전방부에 응력이 집중되어 피로 파절이 발생된 것으로 보았다. 파절면의 SEM으로 관찰결과 응력의 발생과 구강내 환경에 의해 파절면에 다양한 형태가 나타났으며 임프란트에서는 파절면 상부에도 파절선이 진행되고 있음을 관찰할 수 있었다.