

## Case Reports

# Long-term Outcome of Implant Therapy in a Type II Diabetes Mellitus Patient

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*In recent years, implant treatment has been used widely for a range of defective morphologies with a high rate of success. The difficulty of initial placement in diabetic patients were well known. This article describes our experience performing implant treatment on a type II diabetes patient 13 year earlier, and our subsequent observation of his progress.*

*Patient: was male, aged 45 years at initial consultation and his underlying disease was diabetes mellitus. The lower left second premolar was extracted in February 1997. In January 1998, an IMZ<sup>®</sup> Twinplus screw-cylinder type dental implant (Aspac Corporation, Osaka, Japan) was inserted and the superstructure was set in July 1998.*

*Maintenance was performed and a panoramic radiography was taken once a year. In present, a panoramic radiography did not reveal any bone resorption around the implant, thus demonstrating good maintenance and stable progress. Cone-beam computed tomography (CBCT) imaging was performed with the patient's consent using the Veraviewepocs 3D system (Morita Corporation, Nagoya, Japan) to stereoscopically confirm the bone condition.*

*The present findings suggest properly performed regular maintenance are essential to archive long-term stability of implants in type II diabetes patients who diabetes control was not sufficient.*

Key words: A type II diabetes mellitus, IMZ<sup>®</sup> twin plus implant system, cone-beam computed tomography, maintenance

## INTRODUCTION

In recent years, implant treatment has been used widely for treating various dental defects with a high rate of success.<sup>1)</sup> Consequently, it is a well-known fact that the number of patients requesting dental implants has increased. Moreover, the number of compromised patients with systemic diseases including high blood pressure, diabetes mellitus, and heart disease who wish to undergo implant treatments is also on the rise. As Japan has the most aged population in the world, there has also been a pronounced increase in the number of geriatric patients seeking this treatment modality. However, performing implant therapy on these compromised hosts can be problematic.<sup>2)</sup> A previous study by Takahashi et al. described the difficulty of initial implant placement and deterioration of postoperative prognosis in diabetic patients due to their susceptibility to concomitant severe periodontal disease (PD) and limitation of capabilities in wound healing.<sup>3)</sup> Therefore particular care needs to be taken when treating diabetic patients. As the usefulness of implant treatment becomes more widely accepted, opportunities for its use in patients with systemic diseases are increasing. There is also a

growing tendency to include diabetic patients with well-controlled symptoms among patients for whom implant treatment is indicated. This study report our experience performing implant treatment on a type II diabetes patient 13 years earlier, and subsequent prognostic observation during 13 years.

## SUBJECT

Patient: Male, aged 45 years at initial consultation

Chief complaint: pain in lower left gum

Current status: pain and swelling sensation in the gum of the lower left second premolar from a few days prior to consultation

Previous medical history: diabetes mellitus (fasting blood glucose (FBG) of 240 mg/dl and glycated hemoglobin (HbA1c) of 8.7% in 1997). No complications.

Patient's consent of data using for this case study was obtained.

### 1. Present condition

Intra-oral findings: no gum inflammation observed except for that surrounding the diseased tooth

Panoramic radiographic findings: a radiolucent lesion was observed around the root of the lower left second premolar

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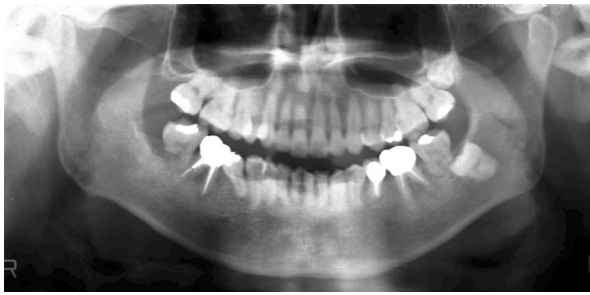


Fig. 1. Panoramic radiography of patients at first examination

indicating root fracture. This tooth was indicating root fracture. Radiolucent areas that indicating decays of dental crown were seen in the upper right second molar and left second premolar and second molar crowns. Bone quality was class 2 according to the Lekholm and Zarb classification.<sup>4,5</sup> (Fig. 1)

Probing pocket depth: Average of full-mouth pocket depth was 2-3 mm

Other exams: O'Leary plaque control record (PCR) 18%; stable centric occlusion

## 2. Treatment plan

The lower left second premolar was diagnosed unretainable due to the root fracture, so, after consulting with the patient's physician, the tooth was then extracted in February 1997. After explaining the patient's options for treating the defective area with a partial denture, bridge, or implant, the patient opted for implant treatment. The patient's severe diabetes meant that the risk of the implant falling out and the surrounding area becoming inflamed was greater for this patient than for a healthy individual,<sup>6</sup> so implant treatment was performed after explaining the need for improved diabetic control and the risks associated with the treatment and obtaining the patient's informed consent. Implant maintenance was done by having the patient visit our clinic at least once a year to undergo a basic periodontal exam (BPE) and plaque control record (PCR) testing, as well as tooth brushing instruction (TBI) and professional mechanical tooth cleaning (PMTC) guidance.<sup>2,7,8,9</sup>

## 3. Treatment and prognosis

The patient's other teeth were treated while the diabetes was being brought under control, and tooth socket healing was well managed despite the patient's elevated FBG (130 mg/dl) and HbA1c (7.4%). Condition of diabetes of the patient was examined regularly by attending physician. Every time of need of the treatment for diabetes, the physician gave medication and dietary medication.

In January 1998, an IMZ<sup>®</sup> Twinplus screw-cylinder type dental implant (Aspac Corporation, Osaka, Japan) with a diameter of 4.0 mm and a length of 11.0 mm was placed with full thickness flap. A panoramic radiograph (Fig. 2) taken immediately after operation showed that implantation had been performed successfully without damaging the adjacent teeth. Following the procedure, the patient made good prognosis. In order to prevent infection, the patient was encouraged to visit the clinic as often as possible, when he visited the clinic, his post-implant condition was

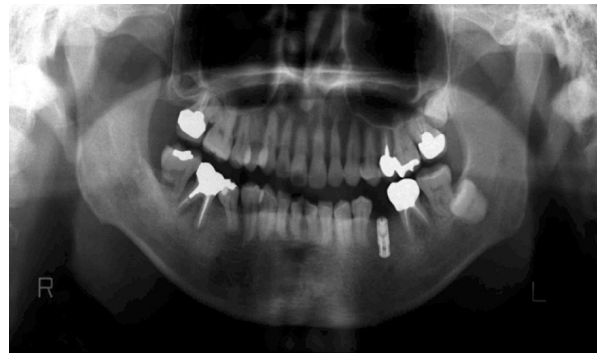


Fig. 2. Panoramic Radiography of patients after inserting implant



Fig. 3. Intraoral Photograph shows the fitting gingiva former to the lower molar region

confirmed, and antibiotics were prescribed when required.

In May 1998, the patient underwent a secondary procedure to fit a gingiva former (Fig. 3). No inflammation was observed in the periodontal tissue of the adjacent teeth, and the presence of adequate keratinized gingiva was confirmed around the implant.

A provisional restoration was subsequently attached for 2 months, and the patient's occlusion, gum condition, and brushing quality were confirmed.

The porcelain fused to metal crown prior to fitting is shown in Fig. 4, and an intraoral photo taken in July 1998 upon attaching the superstructure is shown in Fig. 5. The superstructure was adjusted to the abutment margin to prevent residual temporary cement extravasation below the gingival margin and to facilitate cleaning. A notch was also made on the lingual side of the superstructure to facilitate removal after fitting in the event of inflammation of soft tissue surrounding the implant. Since the defective area was limited to a single molar, the Intra-Mobile Connector (IMC) insert was not used for the abutment on this occasion.<sup>8,9</sup>

The lower right second molar, upper left second molar, and upper left third molar were all diagnosed unretainable, and they were extracted in May 1999, October 1999, and March 2000, respectively. Though the patient's diabetes was not well controlled at these period, with elevated FBG and HbA1c levels, appropriate measures were taken, and

the extractions were completed without any problems.

Maintenance was performed once a year without any delays and comprised a BPE, plaque control check, cleaning by a dental hygienist and, where necessary, cleaning of the transmucosal implant extension (TIE) after temporarily removing the superstructure.<sup>9</sup> Oral cleaning instruction focused on the area around the fixture to ensure stability of the tissue surrounding the fixture neck. BPE revealed overall pocket depth of 2-3 mm, PCR of  $\leq 20\%$ , and stable occlusion. Radiographic findings were also good, with no major changes in bone resorption at the implant neck.

A decade after the superstructure was first attached, the patient visited our clinic in November 2008 complaining of biting pain in the lower left second molar. The need

to remove the lower left second and third molars was explained to the patient due to the difficulty of preserving them. The patient's diabetic control was poor, with an FBG of 119 mg/dl and an HbA1c of 9.3%, so, after achieving an improvement in the patient's condition based on consultation with his family physician, the patient was referred to a local dental and oral surgeon to perform the extractions.

An intraoral photo taken in June 2010 (12 years after attaching the superstructure) is shown in Fig. 6. The patient's FBG and HbA1c at this time were 162 mg/dl and 8.3%, respectively, but no redness or swelling of the gums was observed, and occlusion was stable. The oral cavity was relatively clean, with a PCR of 19%. BPE findings indicated an overall pocket depth of 3 mm with no bleeding, but a 10 mm pocket was seen in the upper right second molar.

A panoramic X-ray did not reveal any bone resorption around the implant (Fig. 7), thus demonstrating good maintenance and stable progress.

Cone-beam computed tomography (CBCT) imaging was performed with the patient's consent using the Veraviewepocs 3D system (Morita Corporation, Nagoya, Japan) to stereoscopically confirm the bone condition (Fig. 8). The resulting images demonstrated that the bone at the implant site consisted of thick cortical bone and dense cancellous bone, and that the implant was sufficiently stable, with no resorption of the surrounding bone.

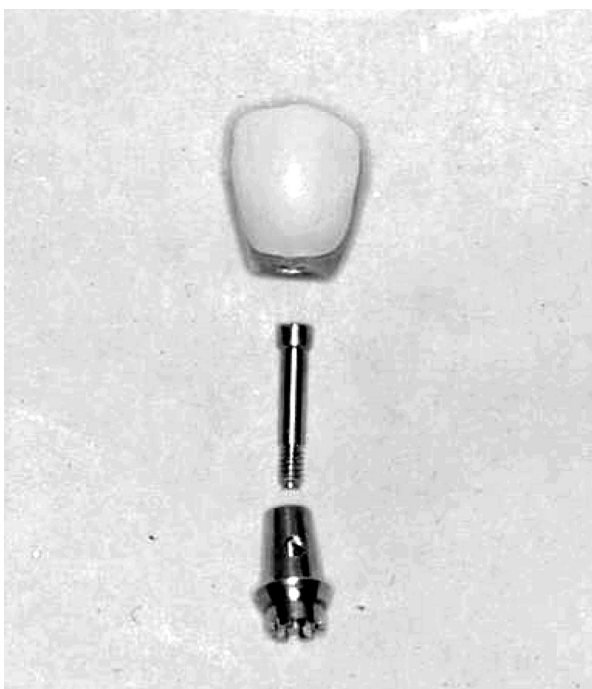


Fig. 4. Photograph shows porcelain fused to metal crown



Fig. 5. Intraoral photograph shows porcelain fused to metal crown (lingual view)



Fig. 6. Intraoral photograph shows the oral cavity 13 years after attaching porcelain fused to metal crown (buccal view)



Fig. 7. Panoramic radiography of patient in a follow-up period

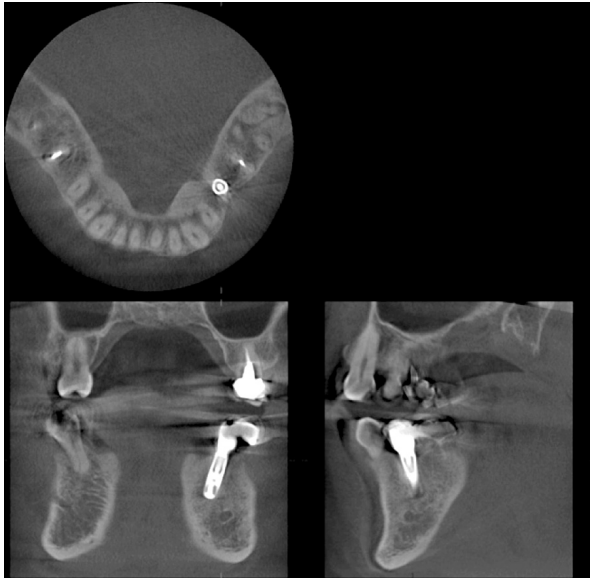


Fig. 8. Cone beam CT images of patient in a follow-up period

## DISCUSSION

Takahashi et al. reported that, for proper implant integration to occur in a diabetic patient, the diabetes must be controlled.<sup>3</sup> According to an implant treatment guideline compiled by the Japanese Society of Periodontology, HbA1c and FBG should preferably be controlled to  $< 6.5\%$  and  $< 130$  mg/dl, respectively.<sup>2</sup> Takahashi et al.<sup>3</sup> also argued that diabetic patients are known to have delayed wound healing due to defects in the connective tissue, as described by Spanheimer et al.<sup>10</sup> and susceptibility to infection owing to reduced neutrophil function, as chronicled by Larkin et al.,<sup>11</sup> while Farzad et al. explained that patients with diabetes were not considered suitable for implant treatment when it was introduced in the 1970s.<sup>12</sup> In recent years, however, there has been a growing perception that diabetic patients can undergo implant treatment as long as it is performed on carefully selected patients by a surgeon experienced in the surgical procedures and perioperative management.<sup>13</sup> However, Fiorellini et al. reported that even diabetic patients with good control have reduced rates of dental implant success and survival compared to healthy individuals, and that few studies have assessed these rates.<sup>14</sup>

In a study by Balshi et al., 34 diabetic patients were treated with 227 Brånemark implants and their prognoses monitored.<sup>15</sup> At the time of second-stage surgery, 214 of the implants had osseointegrated, constituting a survival rate of 94.3%. Only one failure was identified among the 177 implants followed through final restoration, representing a clinical survival rate of 99.9%. The authors suggested that screening for diabetes and trying to ensure that patients requested dental implants were in metabolic control were essential to increase the chances of successful osseointegration.

While we selected an implant with the largest possible diameter to ensure good maintenance, Ohto et al. reported that IMZ implants with a diameter of 4.0 mm and a length

of 11.0 mm deliver relatively good stability, with a 10-year minimum survival rate of 97.0% (1 of 34 implants removed).<sup>16</sup>

A study by Berglundh and Lindhe found that bone resorption occurred at the implant margin when the thickness of the keratinized gingiva was approximately 2 mm in order to establish a transmucosal attachment with a biological height of  $\geq 3$  mm.<sup>17</sup> In the present case, no bone resorption was observed in CBCT images due to maintenance, as indicated by keratinized gingiva with adequate width and thickness.

In terms of maintenance, Abadzhev et al. asserted that although the poor prognosis of implant treatment in diabetic patients has been attributed to the increased risk of peri-implantitis and lack of osseointegration, this prognosis can be improved by clinical and radiographic evaluation of the implants at frequent recall visits.<sup>18</sup> Furthermore, Javed et al. reported that maintaining oral hygiene is highly effective in achieving successful implant osseointegration in patients with diabetes.<sup>19</sup>

In the present case, the patient's ability to maintain implant osseointegration for 13 years was attributed to his keen awareness of the need for oral hygiene and his having attended our clinic for periodic maintenance. Deterioration in the patient's diabetes symptoms could also be managed based on sufficient communication with the family physician. Moreover, good bone mass and quality and sufficiently keratinized gingiva were observed at the defective lower premolar.

In the future, it will be necessary to undertake procedures including extraction of the upper right second molar and to provide ongoing cleaning instruction to prevent further tooth loss in the interest of maintaining occlusal stability with the patient's informed consent.

## CONCLUSION

The present findings suggest properly performed regular maintenance are essential to achieve long-term stability of dental implants in spite that diabetes control was sufficient in type II diabetes patients.

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## II型糖尿病患者におけるインプラント治療の長期経過症例

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近年、インプラント治療を希望する患者が増加し、それにともないインプラント治療を希望する有病者も多くなっている。なかでも糖尿病患者は、インプラント埋入後の予後が不良である。今回我々は、II型糖尿病患者に対しインプラント治療を行い、12年間経過を観察し、若干の知見を得たので報告する。

患者は58歳、男性。1997年1月に左下の歯ぐきが腫れたと訴え来院。下顎左側第2小白歯の歯根破折が認められた。患者は糖尿病治療中でありかかりつけ医に対診後、患歯の抜歯を行った。患者が抜歯部位にインプラント治療を強く希望した。1998年1月にIMZ<sup>®</sup> Twin Plus Implant System (株式会社アスパックジャパン) シリンダータイプを埋入、同年7月に上部構造物を装着した。アバットメントにはIMCインサートを用いないタイプとした。その後、1年毎のメンテナンスとともに、パノラマエックス線写真撮影を行い経過観察した。他歯の治療および抜歯を行ったが、現在まで良好な経過を得られている。今回、メンテナンスと、パノラマエックス線写真および3次的にインプラント体周囲歯槽骨の確認のため、患者の同意を得てコーンビームCT (Veraviewepocs 3D, モリタ) にて撮影を行った。画像処理ソフトにはi-VIEW-3DX (モリタ) を用いた。パノラマエックス線所見、Cone-Beam Computed Tomography (CBCT) 画像所見においてインプラント体周囲歯槽骨は安定した画像を呈していた。

糖尿病患者では歯周病の悪化が考えられ、インプラントの予後に影響すると考えられている。しかし、糖尿病のコントロールが良好でなくても、定期的なメンテナンスを行い口腔内が良好に保たれていれば、糖尿病患者においてもインプラントが長期的に安定すると考えられる。

キーワード：II型糖尿病, IMZ<sup>®</sup> twinplus implant system, cone-beam computed tomography, メンテナンス

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