Retrospective study of the survival rates of a surface-treated external connection implant system

Kwang-Bum Park, Myung-Hwan An, Sang-Taek Lee, Young-Jin Lee, Hyun-Jin Kim, Woo-Chang Noh and Hyun-Wook An present their findings on the survival rates of the Xpeed implant system.

Since the concept of osseointegration was introduced by Bränemark in the 1960s, implants have been widely recommended in the arena of dental treatment with high success rates being reported (Bränemark et al, 1969; Rosenberg et al, 2004; Hammerle et al, 2002, Bahat, 2000). Many authors claim one prerequisite for successful osseointegration is initial stability (Martinez et al, 2001) after implant placement, which depends on the surface characteristics and morphology of the implant and the bone density of the surgical site (Meredith, 1998, Barewal, 2003). At any given time, a number of surface treatment methods are being researched to facilitate rapid, strong osseointegration.

Many studies have been performed on implant success rates and a number of different factors are known to be involved in the long-term success of implants. The height of the marginal bone in particular has been found to be a very important factor in determining the functional and aesthetic success of implants, meaning maintaining appropriate height of marginal bone is a prerequisite for a satisfactory long term result.

After Schnitman et al (1979) presented their criteria for implant success, many other criteria followed (Smith and Zarb, 1989, Misch, 1998, Buser et al, 1999) but the most widely used factors are known to be involved in the long-term success of implants. The height of the marginal bone in particular has been found to be a very important factor in determining the functional and aesthetic success of implants, meaning maintaining appropriate height of marginal bone is a prerequisite for a satisfactory long term result.

After Schnitman et al (1979) presented their criteria for implant success, many other criteria followed (Smith and Zarb, 1989, Misch, 1998, Buser et al, 1999) but the most widely used factors are known to be involved in the long-term success of implants. The height of the marginal bone in particular has been found to be a very important factor in determining the functional and aesthetic success of implants, meaning maintaining appropriate height of marginal bone is a prerequisite for a satisfactory long term result.

Aims and objectives

This article aims to outline the success rates of the Exfeel external implant system using the Xpeed surface treatment, looking at previous studies and methods. Readers will:

• Learn some of the criteria for implant success
• Understand what implant manufacturers hope to achieve with treated surfaces
• See the survival rate of the Exfeel implant

Implant Dentistry Today subscribers can answer the CPD questions on page 54 to earn one hour of verifiable CPD from reading this article.

Materials and methods

Study subjects

The study includes 111 patients who had implant surgery performed at Daegu MIR Dental Hospital, Suncheon MIR Dental Hospital, or Kimhyunjin Dental Clinic from August 2010 and were followed up for two to three years until March 2013. The average age of the patients was 55.2 years old, of which 67 were men and 44 women. A total of 237 implants were placed: 127 of them in men and 110 in women, with 74 in maxilla and 163 in the mandible.

Study materials

The study looked at the externally-connected straight type Exfeel system with Xpeed surface. The implant is available in diameters of 3.3mm, 3.75mm, 4mm, 4.5mm, 5mm and 5.5mm and in lengths of 7mm, 8mm, 10mm, 11mm and 13mm. In this study, 4mm or 5mm diameter implants with a length of 10mm were placed.

Study method

Using medical charts of patients, the following was looked into:

1. Gender of patients, implant distribution and locations
2. Bone quality of implant site and primary stability
3. Placement timing and the use of guided bone regeneration
4. Implant survival rate.

An oral examination and radiograph test were also carried out on all the patients and their smoking status was also checked.

Results

Demographics and implant distribution

A total of 237 Exfeel external fixtures were
placed on 111 patients. Out of these, 127 implants (33.6%) were placed in 67 men (60.4%) and 110 (46.4%) in 44 women (39.6%).

In men, seven out of the 127 implants placed failed and 120 (94.48%) succeeded. In women, four out of 110 implants placed failed and 106 (96.36%) survived – women showed some 1.9% higher survival rate than men (Figure 1a).

Out of 237 implants in total, 74 (31.2%) were placed in the maxilla and 163 (68.8%) in mandible as twice more implants were placed in mandible than maxilla concentrating on left and right molar regions (Table 1).

In maxilla, six out of 74 inserted implants failed and 68 (91.89%) survived, and in mandible, five out of 163 inserted implants failed and 158 (96.93%) survived, with about 5% better survival rate in mandible than maxilla (Figure 1b).

Bone quality and primary stability
The bone quality of implant patients was categorised according to Lekholm classification. In the order of frequency, type II (106), type III (91), type IV (24) and type I (16) were observed (Table 2).

Placement timing and guided bone regeneration
In terms of implant placement timing, 189 implants were placed in healed ridges, 28 were immediately placed and 20 placed with a delayed approach in the order of frequency. In 28 cases of immediate placement, five cases failed. All 20 delayed cases (100%) survived, and of the 189 cases placed in healed ridges, six failed (Table 3).

In 74 guided bone regeneration (GBR) cases, five failed. Of the 34 socket regeneration cases, three failed, and all 28 sinus lift cases survived. Of the 101 cases carried out without GBR, three failed (Table 4).

Survival analysis
A total of 237 implants were placed and 226 of them were still surviving at three months following the placement. Of these surviving implants, all 226 of them went on to survive for more than two years (Table 5).

Analysis of failed implants
There were 11 implants that did not meet the survival criteria, including one osseointegration failure with occlusal problems, three due to smoking and drinking, one burned because of bone quality, two lost by infection, and four loosened after immediate placement or failure to integrate (Table 6).

Discussion
A number of in vivo and in vitro studies have recently been conducted on titanium with Ca2+ ion surfaces. The subject of this particular study was the Exfeel external implant system manufactured by the Korean company, Megagen Implant.

It has an external abutment connection, and features self-tapping threads and cutting edges for good primary stability. Using hydroxyapatite, the surface is treated with resorbable blast media (RBM) with the aim of promoting affinity to bone followed by infiltration of the Ca2+ ion into the surface to form a calcium titanate nanostructure (Park et al, 2009).

The survival rate of implants was defined as the ratio of implants remaining in the mouth, and not removed due to failure at the time of the study.

The criteria for implant failure was taken to include mobile implant fixtures, translucency on structure (Park et al, 2009).
The most widely used implant success criteria by Albrektsson et al (1986) also treats the year following implant placement as a critical timescale. The loading of the implant is reflected in the one-year data; most prostheses would be completed within a year of placement (Carr et al 2003).

Survival table analysis was used in this study based on the assessment of CSR (cumulative survival rate). To assess the cumulative survival rate with 95% confidence level, the data is usually analysed for a duration of five years with assessment performed every year. This method is used in many studies to assess CSR of implants (Cutler and Ederer 1958, Chuang et al 2001).

In many studies assessing implants, a modified survival table is applied depending on follow-up period, implant placement or prosthesis criteria. For this study it was modified in units of five months to assess the one-year CSR.

In this study, all 11 subjects treated with the Excel implant were included, and 11 implants failed before loading, resulting in 95.3% survival rate. There were no failures of any kind for two years after the loading. Therefore, all the failures can be attributed to lack of initial stability.

As to the composition of subjects, male subjects were 20% more than females in number. Implants and patients were evenly distributed among patients in their 20s and under, and in the 50s, but there were more male patients and more implants placed in men among patients in their 30s, 40s and 60s. Increasing numbers of implants and patients were observed in men in their 40s and in women in their 50s.

By implant location, there were 2.2 times more implants placed in the lower jaw than the upper jaw, and most in the posterior region (about 95% of all the implants) than the anterior region. A greater rate of tooth loss in the lower posterior is thought to be the reason for this, as demonstrated in the study by Meskin, Brown et al (1988).

There were 11 implants that did not meet the survival criteria, including one osseointegration failure with occlusal problems, three due to smoking and drinking, one burned because of bone quality, two lost by infection, and four loosened after immediate placement or failure to osseointegrate. Among these were three cases of osseointegration failure and five cases of infection by food, drinking or smoking. Thus the main causes of the failure include infection, drinking, smoking and lack of osseointegration.

As reported by Chuang et al (2001), it is thought that systemic conditions of a patient, such as diabetes, age, osteoporosis, smoking and radiation therapy, influence implant survival rate.

**Conclusion**

This study was performed in a short period of time – less than two years – and it analysed survival rates instead of success rates. The shortcoming of the study lies in the lack of data on prothetic complications.

Despite these constraints, the study showed a 95.3% short-term survival rate of Excel implants with an Xpeed-treated surface, which would indicate the implant can be chosen and used as a stable option. However, a long-term study with more implants is called for.

**REFERENCES**


**Figures 1a and 1b:** Survival rate by patient gender and arch: a) gender b) arch