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**Research Article**

# Evaluation the Success Rate, Survival Rate, and Tissue Health Indices around XiVE® Dental Implants Placed in Patients in a Dental Office in Isfahan

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## Abstract

***Background and aims.*** Despite the very good results, implant treatment has also been associated with some failures. The aim of this study was to evaluate the success rate, survival rate, and tissue health indices around XiVE® dental implants placed in patients in a dental office in Isfahan.

***Materials and methods.*** In this cross-sectional study, 129 XiVE® dental implants were selected. A form was prepared by two periodontists for the collection of demographic information and assessment of soft- and hard-tissue health at the implant sites. Data were analyzed by *t*-test and the Wilcoxon test with SPSS20 statistical software; $p = 0.05$ was considered statistically significant.

***Results.*** Of the 129 implants, 57.3% were in males and 42.7% in females; of the total, 47.3% were maxillary, 52.7% mandibular, and 17.8% were single- and 82.2% multi-unit. Periodontal indices, except probing depth, were significantly lower around maxillary implants ($p < 0.05$). There was no statistically significant difference between the left and right jaws in terms of periodontal index ($p > 0.05$). In all cases, the periodontal indices of dental implants were lower than those of the teeth and showed 100% success and survival rates.

***Conclusion.*** The results of this study showed 100% success and 2-year survival rates with XiVE® implants with healthy tissues surrounding the implants.

***Key words:*** **Dental Implants, survival rate, dental tissue conditioning.**

## *Introduction*

In addition to mental and psychological problems, tooth loss leads to loss of facial esthetics, speech disorders, and diminished masticatory power.[1] Affected patients seek therapeutic solutions to restore missing teeth to improve their quality of life and restore their dental ability and facial esthetics.[2] Dental implants have been considered the solu-

tion of choice for the restoration of missing teeth.[3] The success rate of the implant depends on the osseointegration between the implant and the alveolar bone.[4-6] The implant surface changes the cellular and molecular activity of the surrounding tissues. Thus, the more molecular attachment allowed, the more osseointegration occurs.[7-10]

Although implant therapy has been successful in many cases, side-effects and failures have been reported. Implant failure is multi-factorial. For example, it has been reported that plaque aggregation on the implant surface may lead to the inflammation of marginal tissues and consequently to peri-implantitis, which in turn leads to bone loss and implant failure. The role of the soft tissues in the prevention, initiation, and progress of peri-implantitis is as yet unknown.[11]

The criteria for implant success are always changing and include: immobility of the implant at the initiation of the prosthetic phase, lack of radiolucency around the implant, lack of peri-implantitis, and lack of subjective complaints from patients. The firmness of the alveolar crest and the health of the soft tissue are necessary for long-term implant success.[12] The soft tissue surrounding the implants acts as a protective barrier between the implant and the oral cavity.[13] The same techniques and clinical criteria, such as radiography and periodontal health indices, are used to judge the health of the tissue surrounding the implant and the tooth.[11] There are some accepted criteria for the assessment of implant health. The most commonly reported clinical index is the survival rate of the implant in the oral cavity.[4]

In their study, Payer and colleagues reported 100% clinical and radiographic success rates of XiVE® implants.[14] Degidi et al., in a study carried out on 1005 XiVE® implants loaded by immediate and delayed methods in 371 patients, reported success rates ranging from 99.4 to 98.7% in two groups. They observed no statistically significant difference between immediate and delayed loading methods.[15] In another study, conducted on 1219 three-year XiVE® implants, Wang et al[16] reported a success rate of 97.26%, which indicates the clinical efficiency of the XiVE® implants in restoring missing teeth.

The crestal bone around the implants serves as an important index of implant health. Bone loss in the area of the alveolar crest is the primary index upon which the need for therapy is based.[17] Further, the probing depth of the soft tissue should be considered as an indication of the degree of bone loss. The probing depth around the teeth is an accurate means of evaluating the previous and present health status of both tooth and implant.[17] Progressive probing depth is an important indication of bone loss. Gingival bleeding at the time of probing is related to inflammation, as is the plaque index.[17]

Because of their high success rates, implants are now regarded as the most predictable method for the restoration of missing teeth. Different dental systems have attempted to diversify and improve the mechanical designs and reduce costs to compete in the marketplace, making selection of suitable products difficult. The goal of this research was to assess the success rates, two-year survival rates, and health indices of the soft and hard tissues surrounding XiVE® implants in patients at a private therapeutic center in Isfahan city.

## *Materials and Methods*

This was a cross-sectional observational study carried out in the second half of 2012-2013 in a private therapeutic center in Isfahan city. In total, 129 individuals who had received XiVE® implants in a private therapeutic center in Isfahan city over the preceding five years were selected. After their histories and radiographs were evaluated, they were recalled by the investigator. All individuals were required to sign consent forms to participate in the study. Information was obtained both from the participants and from study of their histories, clinical check-ups, and radiographs. Incomplete files were excluded. The clinical and radiographic indices of the hard and soft tissues around the implants were measured and recorded as follows:

*Gingival index*: The gingival condition was assessed by the Löe Index at mesio-buccal, buccal, lingual, and disto-lingual points of the implant. The plaque around the implant and in the entire oral cavity was computed by the Silness-Löe index. Based on this index, the quantity of plaque on the implant was investigated at the buccal, mesial, lingual, and distal levels. Finally, the mean plaque index was computed for each implant and tooth, and the mean plaque index for the entire oral cavity was obtained.

*Pocket Probing Depth (PPD):* To determine the Pocket Probing Depth (PPD), we measured the distance between the gingival edge and gingival groove depth around the implant and other teeth using a Williams Probe.

*Bleeding index*: The bleeding index was measured by the Mühlemann Index at the mesio-buccal, buccal, lingual, and disto-lingual points of the implant.

*Marginal Bone Loss (MBL):* Bone loss was measured by digital panoramic radiography. The distance from the implant shoulder to the edge of the crestal

bone was measured and recorded based on the threads of the implant at the time of investigation. The findings were compared with reference images photographed immediately after the implant was loaded. The increased distance between the implant shoulder and the edge of the crestal bone, or the dislocation of the crest on the threads relative to the reference images on the mesial and distal sides, was recorded as the degree of bone loss. With regard to the enlargement of radiographs, the dislocation on the implant threads was computed to assess the amount of bone loss. Based on the manufacturer's guidelines and the distances between threads, the exact amount of bone loss was obtained. Data were processed by SPSS software (version 20) and analyzed by descriptive statistical methods.

### *Results*

Of the 129 implants under consideration, 74 cases were loaded in men and 55 cases were loaded in women. The minimum age of the participants was 25 yrs, and the maximum age was 55 yrs (mean, 49.9 yrs). Sixty-one implants (47.3%) were loaded in maxillary bone and 68 implants (52.7%) in mandibular bone. All implants under investigation were of the cement-retained type. Twenty-three of them (17.8%) were loaded with a single-unit prosthesis, and 106 (82.2%) were loaded with a multi-unit prosthesis. The means of the gingival index around the XiVE® implants loaded in both maxillary and mandibular bone were 1.36 mm and 1.67 mm, respectively. The gingival index was 1.52 mm. The gingival index of the implants was 1.53 mm on the right side of both jawbones and 1.51 mm on the left side. The mean of the gingival index for the other teeth was 1.67 mm for maxillary bone, 1.72 mm for mandibular bone, 1.71 mm on the right side of both jawbones, 1.68 mm on the left side of both jawbones, and 1.69 mm in total. The results of the Wilcoxon test indicated a statistically significant difference between the gingival indices of the XiVE® implants and those of the other teeth. However, the results of the *t*-test revealed a statistically significant difference between the gingival indices around the implants loaded in the maxillary and mandibular bones, that is, the gingival index around the XiVE® implants in the maxillary bone was significantly lower than that in the mandibular bone. Further, the difference between the gingival indices of the implants on the left and right sides of the jaw arch was not statistically significant. Also, the differences in gingival indices for the other teeth in the maxillary and mandibular bones and on the left and right sides were not statistically significant. The mean of the gingival bleeding index around the implants at the time of probing was 0.41 mm for the maxillary bone, 0.77 mm for the mandibular bone, 0.58 mm on the right side of the jaw arch, and 0.62 mm on the left side of the jaw arch. The total gingival bleeding index was calculated as 0.6 mm. The mean gingival bleeding index around the other teeth was 0.85 mm for the maxillary bone, 0.91 mm for the mandibular bone, 0.86 mm on the left side of the jaw arch, and 0.90 mm on the right side of the jaw arch. The total amount was computed as 0.88 mm. The findings of the Wilcoxon test showed a statistically significant difference between the gingival bleeding index of XiVE® implants and that of the other teeth. Also, the findings from the *t*-test indicated a significant difference for the gingival bleeding index around the implants between the maxillary and mandibular bone, that is, in this study, the gingival bleeding index around the XiVE® implants in the maxillary bone was significantly lower than that of the mandibular bone. However, the difference between the gingival bleeding indices on the left and right sides of the jaw arch was not significant. The differences in the gingival bleeding indices for the other teeth in the maxillary and mandibular bones and on the left and right sides were also not statistically significant.

The mean plaque index around the implants under consideration was 0.14 mm for the maxillary bone, 0.30 mm for the mandibular bone, 0.26 mm on the right side of the jaw arch, and 0.19 mm on the left side of the jaw arch. The total plaque index, however, was computed as 0.23 mm. The mean plaque index around the other teeth was 22.77 mm in the maxillary bone, 23.77 mm in the mandibular bone, 23.85 mm on the right side of the jaw arch, and 22.77 mm on the left side of the jaw arch. The total index was computed as 23.3 mm. The results of the Wilcoxon test indicated a statistically significant difference between the plaque index of the XiVE® implants and that of the other teeth. Also, the *t*-test showed a significant difference between the plaque indices around the implants of the maxillary and mandibular bones, that is, in this study, the plaque index of the implants loaded in maxillary bone was significantly lower than that of the implants loaded in mandibular bone. The differences in the plaque indices of the implants on the left and right sides of the jaw arch as well as the differences in the plaque index between the other teeth in the maxillary and mandibular bones and on the right and left sides were not statistically significant. The mean probing depth around the implants under study was 2.96 mm

for maxillary bone, 3.08 mm for mandibular bone, 2.96 mm on the right side of the jaw arch, and 3.09 mm on the left side of the jaw arch, with an average of 3.02 mm. This index was computed as 3.04 mm for the other teeth. The results of the *t*-test showed no statistically significant differences for the probing depth indices in the implants located in the maxillary bone, in the mandibular bone, and on the right and left sides of the jaw arch. The mean bone loss around the implants was computed as 1.61 mm for the maxillary bone, 1.91 for the mandibular bone, 1.81 mm on the right side of the jaw arch, and 1.73 mm on the left side. The total bone loss index was computed as 1.77 mm. The results of the *t*-test revealed a statistically significant difference between the maxillary and mandibular bone loss indices around the implants and mandible. The bone loss index of the maxilla was significantly lower than that of the mandible, but the difference between the bone loss indices of the right and left sides of the jaw arch was not statistically significant. In this study, from among 129 implants under consideration, increased gingival volume was observed in only 7 cases (5.4%). All implants survived, and no sign of fracturing was seen. Thus, in this study, the two-year survival rate of the XiVE® implants was 100%, and the location of the implants (in the frontal or posterior parts of the jaws or in mandibular or maxillary bone) had no effect on their survival rate.

### *Discussion*

Tooth loss due to decay, trauma, or periodontitis is a common phenomenon[18] affecting individuals' health, facial esthetics, speech, masticatory power, and psychological health.[19,20] Important changes in the implant field over the past two decades have led to the consideration of implants as a standard method of restoring missing teeth. Indeed, an implant-based prosthesis is the therapeutic method of choice.[21] The criteria for implant success are changing and include: immobility, lack of peri-implantitis, lack of radiolucency around the implants, and lack of patient complaints.[22] The failure of intraosseous implants can occur shortly after insertion and may be related to the time of implant loading with the prosthesis.[23]

In a study conducted by Payer et al,[14] 100% clinical and radiographic success rates were reported for XiVE® implants. Degidi et al, in another study conducted on 1005 XiVE® implants loaded in 371 patients with immediate and delayed methods, reported success rates ranging from 99.4 to 98.7% in the two groups under study. They observed no significant difference between the two methods of loading. Further, Wang et al. investigated 1219 three-year XiVE® implants and reported a survival rate of 97.26%, which indicates the clinical efficiency of XiVE® implants for the restoration of missing teeth.[16]

In this study, the success and survival rates of the XiVE® implants under consideration were 100%. No failure was seen in the implants. The results of this study are in agreement with those from the studies by Payer, Degidi, and Wang. The amounts of plaque index, gingival bleeding index, and pocket probing depth around the XiVE® implants one year after loading were measured by Nothdurft and Pospiech as 0.5 mm, 0.5 mm, and 2.3 mm, respectively.[24]

In this study, the mean gingival index around the XiVE® implants under study was assessed as 1.52 mm. The means of the bleeding index at the time of probing, the probing depth around the implants, and the bone loss were 0.6 mm, 3.02 mm, and 1.77 mm, respectively. In only 4 cases, which were not loose and had no sign of fracture, was the bone loss assessed at more than 3 mm. The results obtained in this study for gingival bleeding, gingival and probing depths and tissue health indices are compatible with those obtained in a study by Pospiech and Nothdurft,[24] because all indices were in the healthy range.

In this study, there was no significant difference between men and women in terms of probing depth indices of the maxillary and mandibular bones, or in terms of bone loss indices. However, the differences in gingival, gingival bleeding, and bone loss indices between the maxillary and mandibular bones were statistically significant; all indices were significantly lower for the maxillary bone. This is likely due to that fact that individuals take better care of their upper anterior teeth for esthetic reasons and find it easier to brush their upper teeth. Contrary to our expectation, the sulcus depth around the implants under consideration was lower than that around the other teeth, probably because the patient took better care of the implants. The two-year success and survival rates of the XiVE® implants in this study were in the same range as reported for other implant systems, computed as 100%. Moreover, the risk factors for implant failure, such as bone loss, radiolucency, inflammation around the implant, and loose implants, were not seen in any cases. Thus, it can be argued that the XiVE® implants are valid alternatives for the restoration of missing teeth. In this study, all periodontal indices of the XiVE® implants under investigation were lower than those of the other teeth, which showed a statistically significant difference. The reasons for this may include: correct surgical and loading methods for the implants, training, the

dentist's advice about caring for the marginal areas of the implant, and the patients' special care for tissue health around the implant.

*Limitations*

The limitations of this study included the small sample size and the impossibility of obtaining measurement of some periodontal indices at the time of implant loading. It is recommended that the same study be conducted with other brands of implants and in a larger sample.

## *Conclusion*

Based on the results obtained in this study, it can be argued that the two-year success and survival rates of the XiVE® implants were 100%, and that all tissues surrounding the implants were healthy after two years.

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