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Systemic and Local Risk Factors for Dental Implants in Partially Edentulous Patients

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Abstract. The aim of this study was to evaluate the incidence of certain risk factors for placing dental implants in partially edentulous patients. Three hundred panoramic radiographs were examined. The bone height that can accommodate the longest possible fixture in edentulous spaces without interfering with vital structures was measured using a glossy template at a magnification of 20%. Medical conditions and smoking habits were also obtained from the patients records. Twenty-four percent of all patients had at least one area of deficient bone height (<7 mm). The region that most commonly exhibited bone height deficiency was the maxillary molar and premolar area (40% and 16% respectively). At least one systemic condition was found in 36% of cases and 12% of the sample were smokers. Fifty-nine percent of all cases had at least one risk factor for implant treatment. It is concluded that ideal local and systemic conditions for implants are uncommon in partially edentulous patients.

Introduction

Dental implants have become a widely used treatment modality in the rehabilitation of completely or partially edentulous dental arches. The advantages of implant-supported prostheses as compared to conventional procedures include improved retention and stability of prostheses, prevention of bone resorption, preservation of adjacent teeth structure, as well as the psychological improvement of patients (Zarb and Schmitt, 1996).

The success of implant treatment depends on careful selection and preparation of the patients (Lekholm, 1998). Preoperative assessment to determine the feasibility of fixture installation includes recording complete dental and medical histories, evaluating the general health of the patient and making a thorough clinical and radiographic examination (Monson, 1994).

The clinical and radiographic examination includes appraising the morphologic features of the proposed implantation site, determining the quality and quantity of available bone and the presence of pathoses, and identifying the relative location of anatomic structures including the maxillary sinus, nasal fossa, incisive canal, mandibular canal and mental foramen.

Panoramic radiography is considered the standard radiographic examination for treatment planning of implant patients due to its low radiation dose and the provision of a good radiographic survey (Dula *et al.*, 2001; Harris *et al.*, 2002; Frei *et al.*, 2004). When used with a radiographic stent, it can provide a fairly accurate assessment of bone height (Oikarinen *et al.*, 1995; BouSerhal *et al.*, 2002).

Implant therapy involves surgical procedures that are considered simple and predictable procedure. However, implantation can be challenging in cases of unfavorable anatomical conditions and in medically compromised patients. Although not all medical conditions were shown to influence implant survival, they may increase the possibility of surgical complications and require certain surgical precaution (Henry, 2000; Hwang and Wang, 2006). Sufficient bone height is a prerequisite for a predictable osseointegration as the implant length has been shown to affect success rate (Chuang *et al.*, 2002; Herrmann *et al.*, 2005). Some patients could not even

be considered for placement of the shortest implant because of the extremely reduced bone height necessary for implantation. Such factors can increase the risks of implant failure and/or surgical complications (van Steenberghe *et al.*, 2002), which in turn might lead patients to reject the implant option out of fear and uncertainty (Muller *et al.*, 1994). Further, it has been suggested to consider alternative prosthetic treatments in the presence of possibly interfering systemic or local factors (Alsaadi *et al.*, 2007). Very little is known in the literature regarding the frequency of implantation risk factors in partially edentulous patients.

The aim of this study was to evaluate the feasibility of placing implants in a sample of partially edentulous patients, and to assess the risks involved with respect to the patients' medical conditions and the height of the available bone.

Materials and Methods

The study sample represented the first 300 patients in the partially edentulous waiting list for replacement of missing tooth/teeth by fixed, removable or implant prostheses. Three hundred panoramic radiographs were collected from patients' records at the College of Dentistry, King Saud University, Riyadh, Saudi Arabia. The panoramic examinations were performed using a Siemens Orthopantomograph model 10 (Siemens, Erlangen, Germany) with Kodak T-Mat L film and Lanex Medium screen (Eastman Kodak Co., Rochester, NY). The patients' mean age was 45 years (range 17-75, 130 men and 170 women).

Using standardized viewing conditions, one examiner measured the maximum height of bone available for inserting fixtures without interfering with vital anatomical structures. The measurements were made using a glossy template (Branemark system, Nobel Biocare, Sweden) with 4 fixture sizes (7, 8.5, 10 and 13 mm) at a magnification of 20%. The edentulous spaces measured were grouped into 3 main areas in each jaw: molar, premolar and anterior areas making a total of 1800 areas. Each area was marked with the longest fixture size possible. If there was more than one tooth missing in an area, the region of the longest fixture was chosen.

The medical history from patients' records was also reviewed to determine any medical condition that required special surgical precautions. Other diseases or conditions that may affect bone metabolism and wound healing were also reported, including smoking and psychiatric problems.

The frequency of deficient bone height between sites in the upper and lower jaws were analyzed by means of Chi-square test using Statistical Package for Social Sciences (SPSS Inc., Chicago, IL, USA).

Results

Sixty-four percent (n=193) of the sample were healthy, while the other 36% were experiencing at least one medical condition. Only 12% (n=37) of the sample were smokers. The medical conditions documented included diabetes (16%), cardiovascular disease (14%), thyroid gland dysfunction (4%) and osteoporosis (2%). Diabetes was the most common condition, affecting 16% of the sample.

The possibilities for implantation in the six areas (anterior, premolar and molar in upper and lower arches) are presented in Fig. 1. The mandibular anterior region showed the least percentage of deficient bone height; implants of 7 mm or more were possible in almost every case. The mandibular premolar and molar regions followed this group. However, no statistically significant difference was found between the frequencies of deficient bone height in the mandible ($p = 0.340$). Analysis of the maxillary jaws showed that limited bone height of less than 7 mm was found in 7% of anterior regions, 16% of premolar regions and 40% of the molar regions. Chi square test showed a highly significant difference between the 3 sites in the maxillary jaw ($p < 0.0001$).

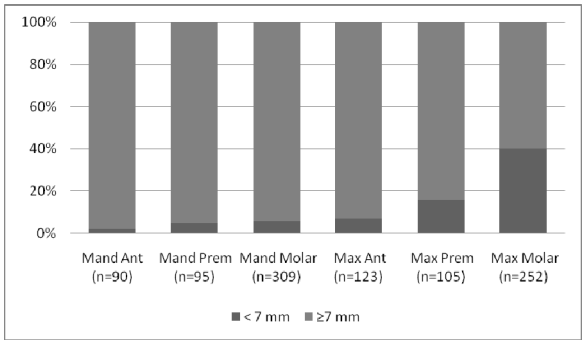

Fig. 1. Relative frequency of bone height in all areas with edentulous spaces. (n=number of areas with edentolous spaces).

The number of patients who had at least one site of deficient bone height (<7 mm) was 73 (24%). When all risk factors that influence the surgical implant procedures were pooled (namely medical condition, smoking and deficient bone height), 59% of patients had at least one risk factor (Table 1).

Table 1. Number and percentage of patients with risk factors

Risk Factor	No. of Patients	%
Maximum Bone Height < 7 mm	73	24%
Diabetes	48	16%
Medical condition (excluding diabetes)	59	20%
Smoking	37	12%
At least one risk factor	176	59%

Discussion

Although panoramic radiographs are widely used for screening potential implant patients, they cannot give an accurate measurement of available bone height due to inherent distortion (BouSerhal *et al.*, 2002; Harris *et al.*, 2002). However, assessment of panoramic radiographs with the use of a glossy template considers a 20% average magnification. This technique could provide a fairly reliable measurement of bone height, sufficient for the aim of the study (Oikarinen *et al.*, 1995). Several other reports have shown that the panoramic radiograph of a correctly positioned patient is sufficient to assess the vertical dimension for dental implants placement (BouSerhal *et al.*, 2002; Frei *et al.*, 2004; Vazquez *et al.*, 2008).

The results indicate that there is a significant percentage of bone height limitation in the lower and upper arch, necessitating bone augmentation procedures. Upper molars and premolars areas showed the highest percentage of bone height limitation, which signifies an increased need for sinus floor elevation procedures. These results are in line with other reports, which showed a decreased possibility for placing implants in the maxilla especially in the molar region (Oikarinen *et al.*, 1995; Bergendal *et al.*, 1994). Guler *et al.* (2005), however, have found more bone height limitation in the upper premolar areas compared to upper molar areas. A recent consensus report suggested that implants placed in augmented areas do not necessarily enjoy the high long-term survival rates of dental implants placed in pristine sites (Tonetti and Hammerle, 2008). Further, McDermott *et al.* (2003) found that reconstructive procedures were associated with an increased risk for complications.

It is fair to assume that the need for augmentation procedures is underestimated. Bucco-lingual width of implant sites was not measured in this study; many more sites likely needed augmentation procedures. This corroborates previous results where additional bone augmentation was indicated in more than 50% of cases (Bornstein *et al.*, 2008).

General health assessment was documented from the patients' records. It is possible that certain medical problems were underestimated because of failure of patients to report their complete health status during the dental interview. Furthermore, it was not possible to determine from the records how many of these medical conditions were controlled. Cases of uncontrolled diabetes or hypertension are contraindicated for surgical implant procedures. The increased surgical risks in medically compromised patients could discourage those patients from accepting the implant treatment option. The anxiety about surgical risks has been shown to be the single most common reason for declining implant treatment (Walton and MacEntee, 2005).

Psychological and personality disorders could not be identified from patients' records, nor could we evaluate the patients' oral hygiene. This could have led to further underestimation of the risk factors in this study. Nevertheless, more than half of patients presented at least one risk factor affecting the implant treatment.

Conclusion

Within the limitation of this study, it is concluded that a conservative estimate of 59% of partially edentulous patients do not qualify for a simple implant surgical standard procedure, due to existing systemic and/or local risk factors. The highest percentage of deficient bone height of less than 7 mm was observed mainly in the maxillary molar and premolar areas.

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عوامل الخطر ذات العلاقة التشريحية والطبية لغرس الأسنان في مرضى الدرد الجزئي

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ملخص البحث. كان الهدف من هذه الدراسة هو تقييم حدوث بعض عوامل الخطر لغرس الأسنان في المرضى الذين يعانون من الدرد الجزئي. تم فحص ٣٠٠ أشعة بانورامية. تم قياس ارتفاع العظام التي يمكن أن تستوعب أطول غرسة ممكنة دون التدخل في المعالم الحيوية باستخدام قالب شفاف بتكبير ٢٠٪، كما تم الحصول على الحالات المرضية وعادات التدخين من سجلات المرضى. أظهرت النتائج أن هناك على الأقل منطقة بارتفاع عظم ناقص (<٧ ملم) في ٢٤٪ من المرضى. وكانت المنطقة الأكثر تأثراً بنقص ارتفاع العظم هي الرحى والضواحك العلوية (٤٠٪ و١٦٪ على التوالي). وقد تم العثور على ما لا يقل عن حالة مرضية واحدة في ٣٦٪ من الحالات و ١٢٪ من العينة كانوا من المدخنين. وكان ٥٩٪ من جميع الحالات لديهم على الأقل عامل خطر واحد للعلاج بالغرس. وخلص إلى أن الظروف التشريحية والطبية المثالية لعملية غرس الأسنان غير شائعة في المرضى الذين يعانون من الدرد الجزئي.