Short Communication

Impact of Osseointegrated Implants on the Selection of Treatment Options in Relation to Tooth Extraction: Comparison Between 1995 and 2005

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This study aimed to examine the influence of osseointegrated implants on decision making for prosthodontic treatments. Twenty-five randomly selected Japanese dental clinicians in 1995 and 2005 with 5 to 15 years of clinical experience were requested to define bone support levels for prosthodontic treatment options. Comparison of the results expressed with the fuzzy function between 1995 and 2000 showed that indications for extraction have expanded with the prevalence of osseointegration concepts. Further, the definition of poor bone quality has changed. Osseointegration has influenced the decision-making process in prosthodontic treatments related to extraction. *Int J Prosthodont 2007;20:402–404.*

One of the most critical decisions in prosthodontic treatment is whether to extract a tooth. This decision involves numerous factors, such as the level of periodontal bone support, tooth position, and condition of the remaining dentition. Decision-making processes are usually analyzed and described using the tree format.[1,2] However, decisions concerning tooth extraction are not easily described with tree formats because of the ambiguity regarding definition of the above-mentioned factors. Therefore, the fuzzy concept was introduced to express each category as a membership function that allows the definitions to overlap.[3]

The purpose of this study was to use membership functions to examine the influence of osseointegrated implants on decision making for prosthodontic treatment by comparing the responses of a group of dental clinicians to questionnaires conducted in 1995 and 2005.

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Materials and Methods

Twenty-five dental clinicians were randomly selected in 1995 and 2005 from a group of 60 general dentists from several different Japanese dental schools (mean age: 36 years in 1995, 38 years in 2005, with 5 to 20 years of clinical experience) regularly involved in the same study group.

Each subject received the same written scenario describing a patient's remaing teeth in the mandible (left premolars, left and right canine, left and right incisors, and right second premolar) opposed by maxillary natural teeth, which were healthy except for the right second premolar. First, each subject was asked to define the bone support level using a percentage range (eg, 10% to 30%) for the terms poor, fair, good, and excellent. Second, they were asked to select the most appropriate treatment option for the mandibular right second premolar for each level of bone support.

The treatment options in 1995 were: *(1)* extraction and placement of a removable partial denture (RPD), *(2)* a cast-metal coping for an overdenture (OD); *(3)* an abutment splinted to the adjacent canine as a fixed partial denture (FPD); or *(4)* a free-standing abutment as an RPD. The following options were added in 2005: *(1b)* extraction and implant placement; *(3b)* an abutment as an FPD plus a molar implant; and *(4b)* implant placement in the molar site.

Accumulated values were then used to produce membership functions for the level of periodontal bone support and each treatment option.

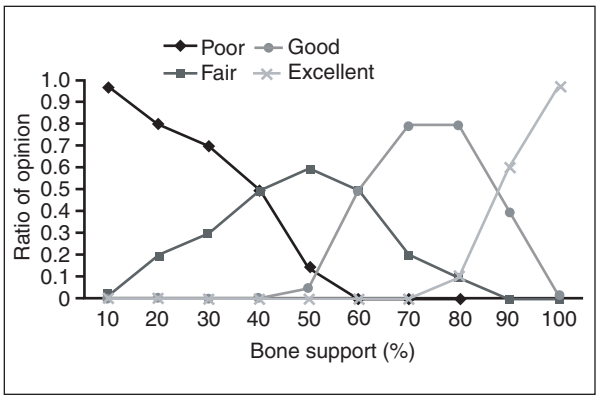


Fig 1a Definition of bone support level using a percentage range for the terms poor, fair, good, and excellent in 1995.

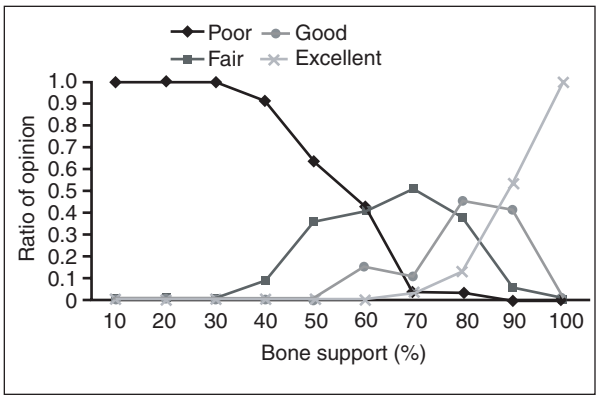
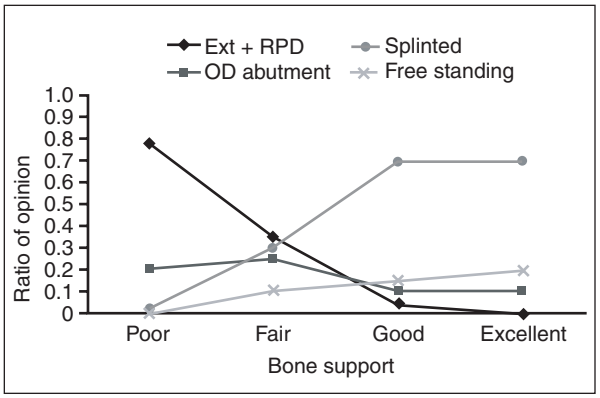


Fig 1b Definition of bone support level using a percentage range for the terms poor, fair, good, and excellent in 2005.

Fig 2 Treatment options for the mandibular right second premolar for 4 bone support levels in 1995.



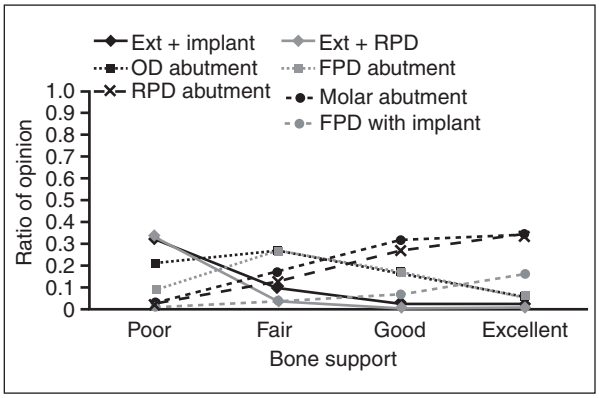


Fig 3a Treatment options for the mandibular right second premolar for 4 bone support levels in 2005.

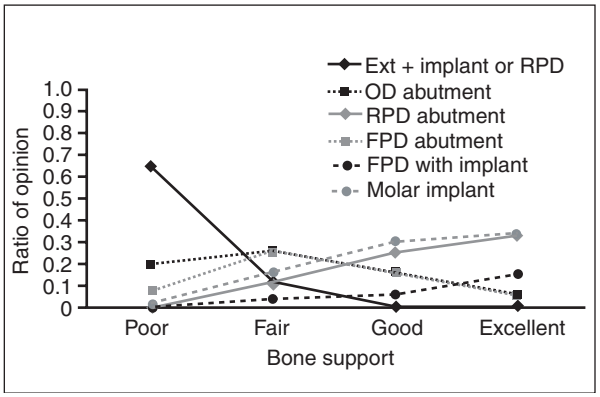


Fig 3b Treatment options for the mandibular right second premolar for 4 bone support levels in 2005 when free-standing abutment–related options were combined.

Results

Comparison of the results between 1995 (Fig 1a) and 2005 (Fig 1b) indicated a large increase in the range of the definition of poor bone quality, even up to 60% bone support in 2005. A shift in the lower end of fair bone quality was also observed.

With the increase of implants after extraction, the ratio for each extraction-related treatment option became lower in 2005 than 1995 (Figs 2 and 3a). However, the ratios for treatment options in 2005 were basically the same as those in 1995, except for the decrease in the splinted abutment. This trend was clearer when extraction-related options (1 and 1a) and free-standing abutment–related options (4 and 4a) were combined (Fig 3b).

Discussion

The introduction of osseointegration may have heightened recognition of bone support level with the increased availability of computerized tomography scans in prosthodontic treatments.[4] The largest change in this study between 1995 and 2005 was in the increased range of the definition of poor bone support. This indicated that the concept of bone preservation by early extraction of so-called questionable teeth with decreased bone support has gradually gained popularity among general practitioners.

Contrary to the definition of the level of bone support, there was little difference in the selection of treatment options, even with additional implant options. When the ratio for extraction-related options (1 and 1a) in 2005 were combined, it was almost the same as the extraction option in 1995. Together with the expanded definition of poor bone support, it is possible to speculate that extractions have increased to preserve the remaining bone with RPDs or implants.

An abutment splinted with a neighboring tooth or implant is still controversial; however, splinting was relatively common in Japan in 1995, as shown in Fig 2. The decrease in the selection of the splinting option in 2005 may reflect the recognition of the side effects of splinting, as well as the increasing popularity of minimally invasive treatments among general practitioners.

Conclusion

Osseointegrated implants have greatly impacted the decision-making process for prosthodontic treatment planning related to tooth extraction.

References

1. Hall WB. Decision Making in Periodontology. Toronto: Decker, 1988.
2. Anusavice KJ. Decision analysis in restorative dentistry. J Dent Educ 1992;56:812–822.
3. Zadeh LA. Fuzzy sets. Information and Control 1965;8:338–353.
4. Lekholm U, Zarb G. Patient selection and preparation. In: Brånemark P-I (ed). Tissue-Integrated Prostheses: Osseointegration in Clincial Dentistry. Chicago: Quintessence, 1985.
5. Nyman S, Ericsson I. The capacity of reduced periodontal tissues to support fixed bridgework. J Clin Periodontol 1982;9:409–414.

Literature Abstract

Survival and complication rates of combined tooth-implant–supported fixed partial dentures

The objective of this retrospective study was to review the incidence of biologic and technical complications in patients with tooth-implant–supported fixed partial dentures (FPDs) on the basis of survival data. Based on the treatment documentations of Bundeswehr Dental Clinic (Cologne-Wahn German Air Force Garrison), the medical charts of 83 patients with tooth-implant–supported FPDs were completely recorded. Only patients who could be further observed for at least 2 years were included. The median follow-up time was 4.73 years (range: 2.2 to 8.3 years). Kaplan-Meier survival curves were applied in addition to frequency counts. The criterion for the time interval up to a modification of the prosthesis, abutment teeth, or implant abutments was the time difference between the respective insertion date and the date of occurrence or the end of observation (censored data). In the process, there were abutment tooth–, implant-, and restoration-related evaluations. A total of 84 tooth-implant–supported FPDs (83 patients) were followed (132 abutment teeth, 142 implant abutments) (Brånemark, Straumann). After 5 years, as many as 10% of the tooth-implant–supported FPDs already had to be subjected to a technical modification (renewal [n = 2], reintegration [n = 4], veneer fracture [n = 5], fracture of frame [n = 2]). In contrast to nonrigid connection of teeth and implants, technical modification measures were rarely required in case of tooth-implant–supported FPDs with a rigid connection. There was no statistical difference between technical complications and the implant system used. During the observation period, none of the functionally loaded implants (n = 142) required removal. Three of the 132 abutment teeth were lost because of periodontal inflammation. The time-dependent illustration reveals that after 5 years as many as 8% of the abutment teeth already required corresponding therapeutic measures (periodontal treatment [5%], filling therapy [2.5%], endodontic treatment [0.5%]). After as few as 3 years, the connection-related complications of implant abutments (abutment or occlusal screw loosening, loss of cementation) already required correction in approximately 8% of the cases. In the utilization period there were no screw or abutment fractures. The authors concluded that in the case of tooth-implant–supported FPDs, use of rigid connections will result in responses similar to implant-supported FPDs. However, this conclusion should be interpreted with caution considering the retrospective nature of the study.

Nickenig H-J, Schafer C, Spiekermann H. *Clin Oral Implants Res* 2006;17:506–511. **References:** 16. **Reprints:** Dr Hans-Joachim Nickenig, Department of Prosthodontics School of Dental Medicine, University of Aachen, Pauwelsstrasse 30, G-52074 Aachen, Germany. E-mail: dr.a.nickenig@t-online.de—*Tapan N. Koticha, National University of Singapore Faculty of Dentistry, Singapore*