Clinical Problem Outcomes in Implant Therapy—A Methodologic Challenge

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After the principle of osseointegration had been introduced into dentistry, clinical research initially focused on studies of dental implant survival. As far as the prosthetic suprastructures were concerned, the research was limited to details that may have presented themselves at the same time.

However, in connection with implant-supported dental restorations, the question arises as to the cost of keeping the structure functional as a whole. To answer it, all levels of prosthetic care must be taken into account: the implant-to-bone interface, the stability of the implant, and the mesostructure, as well as all components of the prosthetic suprastructure. We are dealing here with a very complex research issue that has been in the focus of dental science since the 1990s. In this article, five studies are analyzed that take a holistic approach to evaluating the clinical problems of dental restorations on implants. They differ in terms of the types of issues raised and analysis of the problems observed. The entities investigated are physiologic outcome, probability of biologic and technical complications, patient satisfaction, and initial and maintenance costs. An important challenge for the future will be to lay down standards for describing and investigating such cases and their outcomes.

The studies discussed here were selected as the basis of analysis because they evaluate different dimensions of the clinical case development simultaneously. The studies are case control studies[1–3,5] and one randomized control study.[4] The follow-up interval is between 3 years[2] and 10 years.[5] In all studies, the subjects are patients with an edentulous jaw restored with implant-supported suprastructures. This article deals with the methodology of presenting the cases and their follow-up.

Categories of Events and Procedures

Each of the five studies takes a specific approach to describing the case. The focus is more on clinical procedures than on clinical events. The definition of the procedures is closely linked to the prosthodontic technique applied. Maintenance measures, eg, professional cleaning of the suprastructures and implants, have only been included in the analysis to a limited extent.

Table 1 provides an overview of the items of the analysis.

Clinical Measures—Quantification

The absolute frequency of adjustments is a method very often used for describing the course of treatment.[1,4] It distinguishes between scheduled and nonscheduled visits.[2] In addition, information about mean frequencies of specific aftercare and treatment during the evaluation period[4,5] is provided. Another measure of the frequency of complications is the number of patients requiring maintenance events per year.[3]

To determine treatment severity, either the practitioner hours are documented[2] or the average time spent on aftercare assuming standardized treatment time.[5] Moreover, it is suggested to specify the ratio of the time for initial treatment to the time for aftercare.[5]

In general, it can be stated that the response variables differ significantly, which strongly limits the comparability of the studies.

Treatment Costs

The treatment costs are specified in the authors' national currencies. The data are based on the current version of the respective national or institutional dental fee regulations. They include data on total maintenance costs[1,4] and mean values.[3] In some instances, a distinction is made between maintenance costs, prosthodontic costs, and recall costs,[3,4] whereby different definitions and guidelines are used. Indirect costs, such as patients' productive working hours or spare time, medication travel time, and environmental costs, are also considered.[3] One method of separating such data from the national fee regulations is the ratio of initial costs to aftercare costs.[4]

Consequences

The principal aim of the studies discussed here was to prove that the prosthodontic technique investigated in each of them meets the given requirements. This aim has been reached by all authors. In the future, such studies will focus more on explaining the specific weaknesses of one concept in comparison with others in order to identify optimization options of implant-supported dental restorations. Besides, patients expect an overview of the treatment costs after incorporation of the prosthetic restoration. In this context it is of special interest to determine the monitoring measures that are able to prevent clinical problems effectively. Therefore, dental science is now facing the challenge of standardizing its methodologic approach and, thus, improving significantly the comparability of

Table 1 Clinical Problem Outcome, Items of the Analysis

	Categories of events/procedures
Walton and MacEntee,[1] 1993	**Adjustments** Any treatment that could be done without repairing or adding to the treatment **Repairs** Fixed: fracture of some component (screws) Removable: loose or fractured retentive clips, relines **Routine prevention**
Chaffee et al,[2] 2002	**Scheduled/nonscheduled visits** **No adjustments required** **Adjustments required** Denture adjustments, ball housing complications, prosthetic tooth complications, relines of mandibular and maxillary conventional dentures, abutment complications (tightening, replacement), miscellaneous complications
Attard and Zarb,[3] 2005	**Maintenance procedures** Conversion of prosthetic plan, damaged framework screws, damaged abutment screws, fractured framework (fixed prosthesis or Dolder bar), fractured denture teeth, fractured opposing denture, damaged clip mechanism, loose framework, laboratory reline of opposing denture only, laboratory reline of overdenture only, prosthesis adjustments, remake of implant prostheses, remake of new opposing denture
Stoker et al,[4] 2007	**Specific aftercare treatment** Overdenture—fracture, overdenture—remake, overdenture—rebasing **Mesostructure** Renew retention element, abutment fracture, screw fracture **Assorted** Renew tooth (prosthesis), remounting, occlusal repair
Visser et al,[5] 2009	**Maintenance procedures** Routine prevention and after-treatment inspection, oral hygiene instructions, removal of calculus, consult without treatment Repair of denture teeth, repair of denture base, fabrication of new milled bar, replacement of Ceka attachment, fabrication of new denture, adjustment of occlusion level, reline of overdenture, repair of milled bar, grinding of occlusion, activation of Ceka attachment, relief of sore spots, replacement of screws/abutments, lengthening of denture base rim

the results of studies. Clinical research should, therefore, analyze comparable entities of tissue-integrated prosthodontic constructions in order to detect the specific weaknesses of a given system. Furthermore, a common backbone taxonomy of relevant entities of clinical outcome and its costs is needed to overcome the case-by-case resolution of incompatibilities.

References

1. Walton JN, MacEntee MI. A retrospective study on the maintenance and repair of implant-supported prostheses. Int J Prosthodont 1993;5:451–455.
2. Chaffee NR, Felton DA, Cooper LF, Palmqvist U, Smith R. Prosthetic complications in an implant-retained mandibular overdenture population. J Prosthet Dent 2002;1:40–44.
3. Attard NJ, Zarb GA, Laporte A. Long-term treatment costs associated with implant-supported mandibular prostheses in edentulous patients. Int J Prosthodont 2005;2:117–123.
4. Stoker GT, Wismeijer D, van Waas MA. An eight-year follow-up to a randomized clinical trial of aftercare and cost-analysis with three types of mandibular implant-retained overdentures. J Dent Res 2007;3:276–280.
5. Visser A, Raghoebar GM, Meijer HJ, Vissink A. Implant-retained maxillary overdentures on milled bar suprastructures: A 10-year follow-up of surgical and prosthetic care and aftercare. Int J Prosthodont 2009;2:181–192.

The Use of Computer-Aided Engineering in the Fabrication of Immediately Loaded Fixed Complete Dentures (All-on-Four Hybrid Prostheses)

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A unique prosthetically driven protocol has been developed that uses computer-aided engineering (CAE) to develop sophisticated, scientific algorithms that guide the fabrication of a conversion denture using established digital complete denture fabrication technology. The process begins by acquiring clinical records for fabrication of conventional AvaDent digital dentures (Global Dental Science; Fig 1). The data obtained from scans of these clinical records are used to fabricate provisional complete dentures along with