

Influence of Implant and Conventional Protheses on Satisfaction and Quality of Life: A Literature Review.

Part 2: Qualitative Analysis and Evaluation of the Studies

Christoph Strassburger, DDS, Dr Med Dent^a/Thomas Kerschbaum, DDS, Dr Med Dent Habil^b/
Guido Heydecke, DDS, Dr Med Dent Habil^c

Purpose: To review the influence of prosthodontic and dental implant treatment on patient satisfaction and oral health-related quality of life (OHQOL) based on a systematic search of the literature. **Materials and Methods:** A systematic literature search was carried out for articles published between 1960 and February 2003. Details of the search process and results were reported in Part 1 of the study (*Int J Prosthodont* 2004;17:83–93). The included studies were categorized and evaluated according to their level of evidence, following the guidelines of the Agency for Health Care Policy and Research. The characteristics and content of the studies were analyzed and tabulated. **Results:** Among the 114 included studies, there were 76 publications reaching evidence level III. The results showed that the effects of compromised oral health are not limited to traditional clinical aspects, but can considerably affect patients in various activities of daily life. Twenty-four of the 38 investigations with evidence levels I and II dealt with implant stabilization of complete mandibular protheses, comparing implant protheses to conventional complete dentures. Fully edentulous patients experience negative impacts on OHQOL from their condition. They benefit significantly from the use of dental implants to support mandibular protheses. However, support by more than 2 implants does not appear to further significantly increase patient satisfaction and OHQOL. **Conclusions:** To date, research in the field of patient-based outcomes has concentrated on dental implant treatment for the edentulous patient. Other prosthetic treatments such as single crowns, fixed and removable partial dentures, or further treatment concepts (eg, the shortened dental arch concept) are not well represented. The use of patient-centered outcome measures can help to find an individual, patient-oriented prosthetic solution. *Int J Prosthodont* 2006;19:339–348.

There is ample evidence that oral health and the rehabilitation of the chewing apparatus, such as via dental protheses, have manifold ramifications for patients. During the past 2 decades, a field of research concerned with patient outcomes of dental and prosthetic therapy has emerged.^{1–6} Simply inquiring about patients' general satisfaction with dental protheses

often does not suffice when assessing the impact of dental treatment on patients. Detailed questions with regard to specific aspects of the protheses give insight into which aspects are improved by dental protheses with or without implant support. Such factors include satisfaction with comfort, esthetics, ease of cleaning, and chewing function. However, data generated by such variables do not capture the impact of different types of protheses on the activities of daily life. Oral health-related quality of life (OHQOL) has been defined as a more comprehensive multidimensional assessment of the consequences of prosthetic rehabilitation.^{7,8} OHQOL can be defined as the part of quality of life that is affected by a person's oral health. In particular, this term captures how oral health affects the person's ability to function (eg, bite, chew, speak), psychologic states (such as self-esteem and satisfaction with appearance), social factors, and pain/discomfort related to oral health.⁹

^aPrivate Practice, Cologne, Germany.

^bProfessor and Chair, Preclinical Dentistry, School of Dentistry, University of Cologne, Cologne, Germany.

^cVisiting Professor, Faculty of Dentistry, McGill University, Montréal, Canada; Associate Professor, Department of Prosthodontics, School of Dentistry, University Hospital, Freiburg, Germany.

Correspondence to: Prof Dr Thomas Kerschbaum, School of Dentistry, University of Cologne, Department of Preclinical Dentistry, Kerpener Str 32, D-50931 Koeln, Germany. Fax +49 221 478 5964. E-mail: T.Kerschbaum@uni-koeln.de

The purpose of this review was to investigate the influence of prosthetic restorations on patients' OHQOL and satisfaction on the basis of 114 clinical studies. These studies were located by a systematic literature search, covering the period between 1960 and February 2003, which was complemented by a manual search. Among the 207 publications identified, there were 114 relevant studies, with 24,863 patients studied in total.^{10,11} The materials and methods, particularly the search strategy, have been described in Part 1 of this article.¹⁰

The central research question to be answered was: What are the effects of prosthodontic treatment on patient satisfaction and OHQOL in adults?

Materials and Methods

A systematic literature search was carried out for articles published between 1960 and February 2003. The studies included were categorized and evaluated according to their level of evidence following the guidelines of the Agency for Health Care Policy and Research (AHCPR).¹² Further details of the search process and results have been reported in Part 1 of the study.¹⁰

Results

Studies with Low Levels of Evidence (AHCPR III) and the Development of the Instruments

Among the articles with a low level of evidence, the results of 76 studies with evidence level III, ie, nonexperimental studies, will be discussed.¹³⁻⁸⁸ These are essentially retrospective studies performed primarily in edentulous populations.

The findings of this group of basic research identified OHQOL as a multidimensional concept comprising clinical effects on psychosocial dimensions.

The most important study from this period is from 1967, written by Carlsson et al,²¹ who investigated the satisfaction of wearers of complete dentures. This study already included psychosocial aspects. Whereas approximately 90% of subjects reported satisfactory adaptation to their complete denture, 24% complained about insufficient retention of the mandibular prosthesis, and another 20% regarded their prosthesis as an "impediment."

Other retrospective studies, usually focused on general satisfaction, produced very high satisfaction rates of 83%, averaged from all types of treatments (the percentage has been calculated as the mean value of general satisfaction from all studies using visual analog scales [VAS]) (SD = 12.4).^{18,20,21,29,31,33,36,45,50-53,60-62,64,66,67,72,73,75-77,79-82,86,88-103} High general satisfaction, however, did not exclude specific explicit criticisms. The high general satisfaction score may be related to the fact that general questions usually

yield more positive responses than narrowly focused items.¹⁰⁴ The criteria for the assessment of patient satisfaction in this early period were basically confined to traditional clinical factors such as esthetics, fit, chewing ability, or simply general satisfaction. The consequences of inadequate prosthetic therapy, however, are not limited to these traditional, mainly clinical factors, but can considerably affect patients in various activities of daily life. Elderly patients, who often suffer from general medical ailments, are particularly exposed to the dangers of malnutrition and social isolation, which can aggravate general infirmity and frailty.^{20,41,50,51,105}

A higher quality of investigation emerged with a study by Smith and Sheiham,²³ published in 1979, on the negative effects suffered by elderly people as a result of prosthetic therapy and poor oral health. The authors visited 254 patients over 65 years old (74% of whom were totally edentulous) and conducted a structured interview. In this way, participants could voice their concerns freely. A quarter of the interviewees reported pain when eating and 41% needed more time for chewing because of insufficient chewing ability. As a result, patients reported (psychologic) discomfort when eating in company. For the first time, the relationship between unsatisfactory prostheses and daily activities became evident. This created a demand for a specific instrument for data elicitation that could adequately capture the psychosocial effects of impaired oral health.

Publications on the Development of Instruments to Specifically Assess OHQOL

Almost another 10 years passed before Cushing et al²⁴ proposed the inclusion of social and psychologic factors into the indices of dental epidemiology in a 1986 publication. They found that existent indices, such as DMFT, were ineffective for expressing the subjective oral health experiences of patients, since individual experiences regarding the oral situation are variable and include psychosocial components. In this study, the authors devised "socio-dental indicators" for evaluating the effects of dental diseases.

Subsequently, further indices were developed and applied, for instance, the Geriatric Oral Health Assessment Index³⁸ in 1990 or the Dental Impact Profile³⁹ in 1993. Another approach was to combine several highly specific indices into larger questionnaire batteries.^{16,26} These indices as well as the use of generic quality-of-life instruments, such as the Short Form 36, did not yield convincing results, in the latter case because they were nonspecific and thus not sensitive enough to capture changes in oral health.^{43,98} It is also obvious that measurement instruments specifically developed for oral health are superior to general indices

Table 1 No. of Articles Retrieved by the Search After Application of Inclusion Criteria: Categorized by Oral Situation

	AHCPR evidence level			
	Ia	Ib	IIa	IIb
Edentulous				
Maxilla	0	16 ^{89,93-99,102,111-117}	6 ^{109,110,118-120,127}	12 ^{91,92,100,101,103,108,121-126}
Mandible	0	16 ^{89,93-99,102,111-117}	5 ^{109,118-120,127}	11 ^{91,92,101,103,108,121-126}
Partially edentulous				
Maxilla	0	0	1 ¹²⁹	1 ¹⁰³
Mandible	0	1 ¹²⁸	2 ^{129,130}	2 ^{90,103}
Single tooth restorations				
Maxilla	0	0	0	0
Mandible	0	0	0	0

in prosthodontic applications.^{43,98} One instrument has prevailed in terms of frequency of use: the Oral Health Impact Profile (OHIP), introduced by Slade and Spencer in 1994.⁴⁰ It was based on Locker's² concept of how oral health affects quality of life, which in turn is an adaptation of the 1980 World Health Organization's definition of "Impairments, Disabilities, and Handicaps."¹⁰⁶ The OHIP was refined extensively and today several validated translations are available. In addition, shortened versions with 14 and 20 items have been introduced, including the 20-item form OHIP-EDENT, which is designed specifically for edentulous populations with regard to prosthetic therapy.^{98,107,108} In addition, the index proved its high ability to discriminate among different patient populations in further investigations.⁴²⁻⁴⁴

Studies with High Levels of Evidence (AHCPR I and II)

In this section, 38 investigations with evidence level I and II are presented. Most publications focused on edentulous patients (Table 1). Among the 17 studies with evidence level Ib (randomized controlled trials [RCT]), there were 16 papers dealing with complete denture therapy. All 17 studies included implant therapy. A similar distribution of therapeutic approaches is found among the studies with evidence levels IIa and IIb. Studies focusing on the treatment of edentulous patients with implant prostheses dominate the picture; there are a limited number of reports on implant treatment of partially edentulous jaws.

Treatment options for the edentulous maxilla.

Two RCTs were identified that dealt with the treatment of the edentulous maxilla.^{96,98} Both studies were conducted using a crossover design. Chewing ability and satisfaction were assessed with VAS and categorical scales. Compared to the pretreatment evaluation with conventional dentures, one study showed increased satisfaction after insertion of implant-supported removable overdentures; however, there was no differ-

ence between dentures with and without palatal coverage.⁹⁶ The second study was able to demonstrate a higher degree of general satisfaction, better speech quality, and more ease of cleaning with removable overdentures than with fixed implant-supported prostheses (Table 2a). Nine of 13 patients chose the removable overdentures at the end of the trial.⁹⁸ Further studies with evidence levels IIa and IIb came to varied conclusions. There is general consensus that implants in the edentulous maxilla appear to be a recommendable option, especially for patients who show unfavorable anatomic conditions or fail to adapt to conventional treatment.^{92,100,109,110} In most cases, completely edentulous patients gave less favorable ratings to conventional mandibular prostheses because the anatomic condition of the maxilla often allowed acceptable results even with conventional removable prostheses.⁹⁶

Treatment options for the edentulous mandible.

Twenty-four of the 38 investigations with evidence levels I and II dealt with implant-supported complete mandibular prostheses, comparing implant prostheses to conventional complete dentures.^{89,93-95,97,99,102,108,111-126} Implant-supported prosthetic devices were generally judged more favorably in patients' subjective ratings and created higher general satisfaction rates (Table 2b). Most authors support a simple bar construction or ball attachments for overdentures.^{92,94,97,99,114,115,117,124,102,109,116,120,122,125-127} Placement of more than 2 implants does not appear to further increase patient satisfaction.⁸⁹ The postulated advantages of fixed implant-supported prostheses (ie, that they simulate the physiologic situation more closely and are more stable) were also put into perspective.^{93,95,112} Surprisingly, about half of all patients preferred removable overdentures to fixed partial dentures in 1 randomized crossover trial for specific reasons: Those who judged stability and chewing ability as the more important factors chose fixed prostheses, while those who judged ability to clean and esthetics more important selected removable overdentures.¹³¹

Table 2a Main Outcomes of the Studies on Treatment of the Edentulous Maxilla

Outcome measure	Removable implant overdenture	Fixed implant prosthesis	Conventional removable denture
OHQOL	N/A	N/A	Within-group improvement of 15 points (OHIP-49) after remake ($P = .02$) ¹⁰⁸
Satisfaction	Very high ratings (CAT scales) ¹⁰⁰ ; significant improvement compared to conventional complete dentures, no difference with and without palates ⁹⁶	Very high ratings (CAT scales) 3 years posttreatment ¹⁰³ ; significantly less satisfaction than with removable overdentures (40 mm on 100-mm VAS) ($P = .003$) ⁹⁸	Significantly higher satisfaction than mandibular complete dentures ⁵⁰ ; slight improvement after remake ⁹⁶
Additional sources	92,98		22,89,91,92,94,100,101,109
Esthetics	Very high ratings (CAT scales) ¹⁰⁰	Very high ratings of general satisfaction (CAT scales) 3 years posttreatment (70% of patients) ¹⁰³ ; significantly lower ratings of esthetics than with removable overdentures (17 mm on 100-mm VAS) ⁹⁸	Mostly high ratings after remake ⁵⁰
Additional sources			22
Chewing ability	Very high ratings (CAT scales) ¹⁰⁰	90% of patients have optimal chewing function ¹⁰³	Often reduced chewing ability; slight improvements after remake ⁹
Additional sources	92,98	98	22,92,101
Cleaning ability	Significantly easier to clean compared to fixed prostheses ($P = .004$) ⁹⁸	Significantly harder to clean than removable overdentures (49 mm on 100-mm VAS) ⁹⁸	Very favorable ratings
Stability, comfort	Very high ratings (CAT scales) ¹⁰⁰	90% of patients have optimal chewing function (CAT scales) ¹⁰³	Often poor but usually better than in the mandible ²² ; slight improvement after remake ⁵⁰
Additional sources	92		89,92,100-102
Speech function	Very high ratings (CAT scales) ¹⁰⁰ ; significantly better than fixed implant prostheses ⁹⁸	Significantly worse than removable overdentures (40 mm on 100-mm VAS scales) ($P = .036$) ⁹⁸	Reduced ratings; slight improvements after remake
Additional sources	92	103	50,92,100,101

Table 2b Main Outcomes of the Studies on Treatment of the Edentulous Mandible

Outcome measure	Removable implant overdenture	Fixed implant prosthesis	Conventional removable denture
OHQOL	Significant 34.5-point within-group improvement (OHIP-49) ¹¹¹	Significant 31-point within-group improvement (OHIP-49) ($P = .001$) ¹⁰⁸	Comparable results to removable overdentures in patients who are well-adapted to conventional dentures (OHIP) ¹²⁰
Additional sources	108,109,120		108,109,111
Satisfaction	30.7-mm within-group improvement (100-mm VAS) following treatment ($P = .0001$) ⁹³	33.5-mm within-group improvement (100-mm VAS) following treatment ($P = .0001$) ⁹³	Comparable satisfaction to removable overdentures in patients who are well adapted to conventional dentures ¹²⁰ ; otherwise poor ratings (see additional sources)
Additional sources	74,92,94,95,97,99,102,108,109,113-115,117,121,122,124-126	103,108,118,119,123	91,92,97,99,101,108,109,113,117-119,121-126
Esthetics	25.4-mm within-group improvement (100-mm VAS) following treatment ($P = .0001$) ⁹³	25.5-mm within-group improvement (VAS) following treatment ($P = .0001$) ⁹³	Worse ratings than implant prostheses ⁹³ ; improved ratings after remake ⁵⁰
Additional sources	89,92,121,122,125	103,118,119	89,92,118,119,121,122,125
Chewing ability	“No impact” (OHIP-49) for 87% following treatment ¹¹¹	67% of patients have optimal chewing function (self-ratings) ¹¹⁸	Only 16% have “no impact” (OHIP-49); improved after remake ¹¹¹
Additional sources	74,92-95,97,99,102,117,121,122,124-126	93,103,119,123	74,91,92,94,97,99,101,102,117-119,121-126
Cleaning ability	Decisive factor for choice of prosthesis in crossover comparison with fixed mandibular prosthesis ⁹³	More difficult than with removable overdentures ⁹³	Very favorable ratings
Stability, comfort	Acceptable retention with ball or bar attachment ¹¹⁵	90% of patients gave “optimal” self-ratings to fixed prostheses for stability ¹¹⁸	Often poor ratings; slight improvement after remake
Additional sources	74,92,95,99,112,114,117,121,124,125	103,119,123	74,92,99,101,102,117-119,121,124,125
Speech function	22.6-mm within-group improvement (VAS) following treatment ($P = .0001$) ⁹³	26.7-mm within-group improvement (VAS) following treatment ($P = .0001$) ⁹³	Often poor ratings; slight improvement after remake
Additional sources	92,117,122	103,118,119	92,93,101,117-119,122

Table 2c Main Outcomes of the Studies on Treatment of Partially Edentulous Patients

Outcome measure	Fixed partial dentures (FPDs)	Mandibular removable partial dentures (RPDs)
OHQOL	Significantly improved quality-of-life scores with implant-retained FPDs for the treatment of a shortened dental arch. Custom questionnaire used. ¹³⁰	No difference on quality-of-life scores between RPDs and no treatment for shortened dental arches ¹³⁰
Satisfaction Additional sources	90% satisfaction ¹²⁸ 103,129	67% of patients satisfied ³¹ 90,128
Esthetics Additional sources	7% better ratings than RPDs ¹³⁰ 103,129	82.1% satisfaction after new RPDs ³¹
Chewing ability Additional sources	28% better ratings than RPDs ¹³⁰ 103,128, 129	82.2% positive ratings after new RPDs ³¹ 128
Cleaning ability Additional sources	Significantly more difficult to clean than RPDs ¹³⁴ 129	84.6% positive ratings of cleaning ability ³¹ 128
Stability, comfort Additional sources	14% higher ratings than new RPDs ¹³⁰ 103,128,129	66.4% positive ratings with new RPDs ³¹ 90
Speech function Additional sources	10% better ratings than new RPDs ¹³⁰ 103,128,129	82.1% good ratings of speech function with new RPDs ³¹ 128

It appears to be certain that OHQOL as measured by the OHIP can be significantly improved by the use of mandibular prostheses stabilized by 2 implants in edentulous patients. Awad et al¹¹¹ investigated the positive impact of implant-supported overdentures in edentulous mandibles in a randomized controlled clinical study. All subscales of the OHIP showed higher values within the implant group. Conventional complete denture treatment can lead to relatively high degrees of OHQOL in patients who have adapted well to the prostheses.¹²⁰

The data from the studies identified in this section used the Patient/Problem, Intervention, Compared to, and Outcome (PICO) format question: In completely edentulous adults at least 18 years of age, what is the effect of removable mandibular overdentures retained by 2 osseointegrated implants in the anterior mandible compared to removable mandibular dentures without implants on patient satisfaction, as measured using a VAS?

In 3 publications, enough data were reported to perform a meta-analysis of the data.^{89,94,116} An inverse variance weighting was used to pool the results of the 3 studies according to sample size. In all 3 cases, general satisfaction was the measured construct. The anchor points were comparable in all 3 cases (“not at all satisfied,” “very/highly satisfied”). The only difference with regard to other publications was that graded 10-point scales had been used. The reported data were multiplied by 10 to make the outcome comparable to other studies that used 100-mm VAS. The computed overall weighted mean difference was 16.4 units (95% confidence interval: 13.1–19.7). The difference between the 2 treatments was significant ($P < .0001$).¹³²

Treatment options for the partially edentulous patient. Investigations of fixed partial denture restora-

tions or removable partial dentures are clearly under-represented (Table 1). There is still a great need for research. Only 1 RCT by Kapur et al⁹⁹ dealing with the shortened mandibular arch could be identified (Table 2c). A second study exploring this topic was a controlled trial without randomization by Kuboki et al,¹³⁰ which reached evidence level IIa. Both investigations favored implant-supported prostheses over conventional dentures or no restoration, although implant constructions were more difficult for the patients to clean. In the second study, no difference in patient-based assessments could be found between wearers and nonwearers of removable partial dentures (in unilateral mandibular distal-extension edentulism).

General Evaluation and Options for Future Research

Methodologic Issues

The use of nonstandardized questionnaires is a point that must be critically acknowledged. The majority of the identified studies did not make use of existing and well-developed instruments, such as the OHIP. Instead, ad hoc designed and often nonvalidated instruments were used. This makes the results less valid, less meaningful, and less comparable. Future research should make use of existing and validated measuring instruments, whether for OHQOL or general satisfaction.

Often, participants in clinical trials came from groups of dissatisfied patients or had reduced OHQOL. While they certainly benefited from implant prostheses, conventional complete dentures still have their place as an

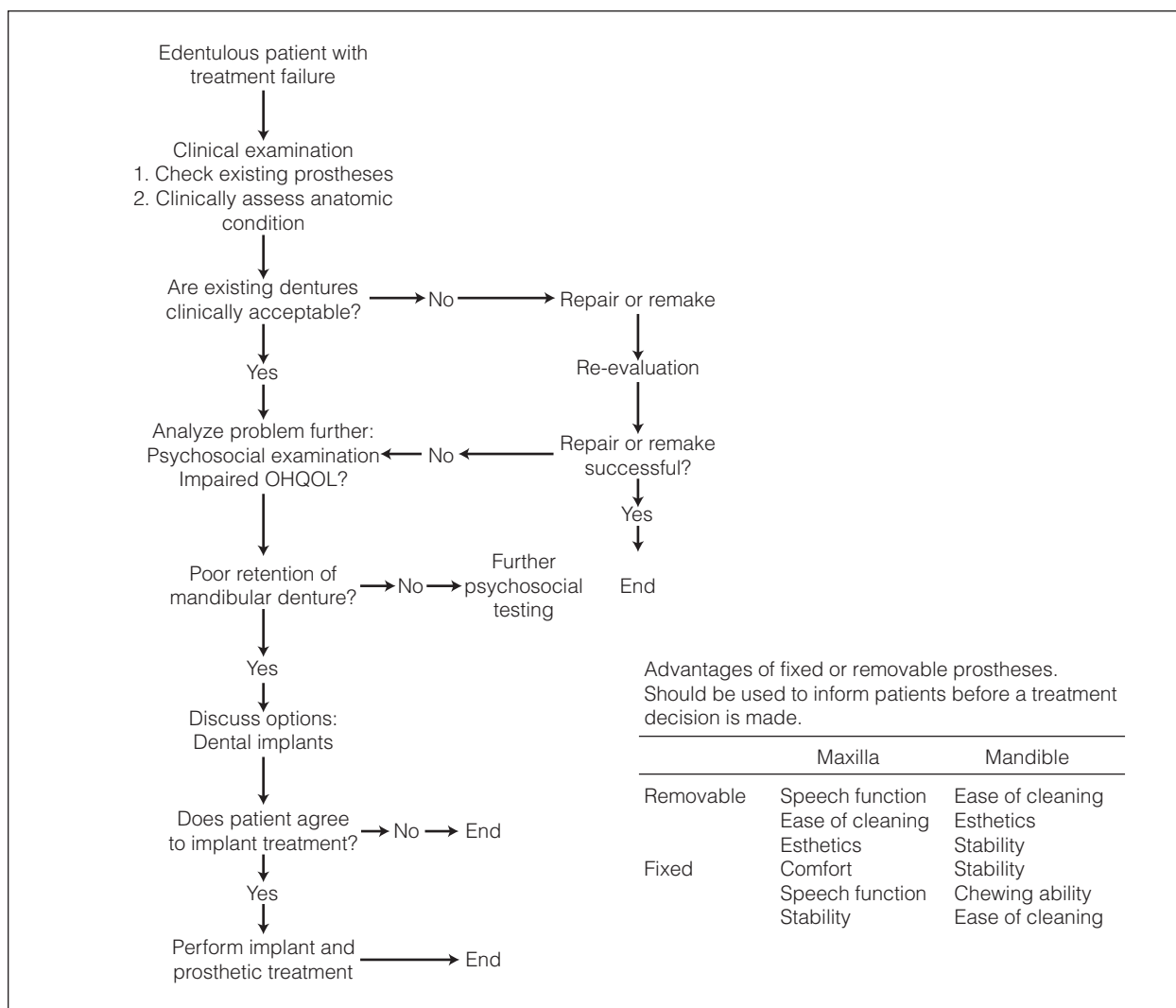


Fig 1 Model of a clinical pathway for an edentulous patient with failed conventional treatment.

adequate and economical treatment for the edentulous arch. Furthermore, psychosocial predictors or outcomes found in clinical trials may not relate very well to general populations. Dental patients may be coping even better with complete or partial edentulism than the clinical studies on implants seem to indicate. Certainly, there is no evidence presented that most denture patients would cope equally well with the higher financial costs of implant prostheses. The call for implant-supported dentures as the standard of care (especially for the edentulous mandible) is well supported by evidence.^{133,134} However, the data were generated mostly in specialized centers with specific patient groups. With regard to the worldwide distribution of wealth, it will be difficult to make implant restorations available to all patients. It will probably be even more difficult to establish implant prostheses as a standard in the poorer regions of the world in a short time.¹³⁵

Evaluation of Content

Modern prosthodontics has developed a sophisticated and still growing range of possible treatments and materials. Strikingly, there is little evidence on how other common prosthodontic treatments such as fixed conventional prostheses affect OHQOL. The relationship between economic issues of dental health and quality of life has not been investigated so far. The impact of the much-discussed esthetic criteria on quality of life is little investigated, as are a number of therapies that regard no treatment (eg, of distal-extension situations) as a better option than completing shortened dental arches.

On another note, while the outcome of questionnaire and survey research is evident for researchers, to date, results have scarcely been helpful for clinical practitioners. Research questions have to be adjusted so that results can be applied in daily practice.

Furthermore, there is a need for instruments that can be used to screen patients before treatment and to perform assessments of risks and prognoses of prospective treatment. Clinicians require tools to filter out patients who would not benefit from (further) prosthodontic treatment.

Recommendations for the Clinical Practice

Based on the current evidence reviewed in this paper, we propose a procedure for how to manage edentulous patients who complain about their conventional complete dentures. The flow chart is depicted in Fig 1. Patients who had previously failed conventional treatment should be interviewed extensively about the reasons for their low satisfaction with the outcome of their original denture treatment. A questionnaire such as the OHIP can be used to screen for the effects of prostheses on activities of daily living. This should be combined with a meticulous clinical examination, and the current prostheses should be checked for technical or clinical imperfections. Then, a repair or a retreatment with conventional means could be considered. If this procedure is not expected to solve the problems or has failed, implant-supported prostheses should be discussed with the patient. As a primary solution, 2 implants and an overdenture retained by ball or bar attachments can be suggested. With proper planning, this type of treatment can be upgraded to a fixed prosthesis at a later stage if additional implants are placed in the posterior area.

Conclusions

Subjective assessment of the oral situation by the patient, ie, via patient-based evaluation, provides vital information for the treating clinician. Similar or even identical clinical situations can be and often are assessed very differently by individual patients with respect to their OHQOL. The enhancement of OHQOL through a specific prosthetic treatment cannot be assumed to be the same for every patient, even though an improvement has been described for many formerly edentulous patients treated with mandibular implant-supported prostheses. Conventional denture therapy can also be an adequate treatment resulting in a high OHQOL.¹²⁰

The entire range of prosthetic therapy has not been sufficiently covered by investigations on OHQOL so far. Conventional fixed partial dentures as well as many variants of removable prostheses have not been investigated with regard to their impact on OHQOL. This also applies to the impact of the technical and constructional quality, which has been traditionally emphasized in many prosthodontic investigations.

References

- Locker D, Clarke M, Payne B. Self-perceived oral health status, psychological well-being, and life satisfaction in an older adult population. *J Dent Res* 2000;79:970-975.
- Locker D. Measuring oral health: A conceptual framework. *Community Dent Health* 1988;5:3-18.
- John M, Micheelis W. Lebensqualitätsforschung in der Zahnmedizin: Konzepte Erfahrungen und Perspektiven. *IDZ-Information* 2000;4:2-22.
- Gift H, Atchison K. Oral health, health, and health-related quality of life. *Med Care* 1995;33:57-77.
- Gift H, Atchison K, Dayton C. Conceptualizing oral health and oral health-related quality of life. *Soc Sci Med* 1997;44:601-608.
- Giddon D. Oral health and the quality of life. *J Am Coll Dent* 1987;54:10-15.
- Heydecke G. Implantologie—Wohlbefinden für Senioren. *Zahnärztl Mitt* 2000;90(21):52-57.
- Heydecke G. Patientenbasierte Messgrößen: Mundgesundheitsbezogene Lebensqualität. *Schweiz Monatsschr Zahnmed* 2002;112:605-611.
- Inglehart M, Bagramian R. Oral health related quality of life: An introduction. In: Inglehart M, Bagramian R (eds). *Oral Health Related Quality of Life*. Chicago: Quintessence, 2002:1-6.
- Strassburger C, Heydecke G, Kerschbaum T. Influence of prosthetic and implant therapy on satisfaction and quality of life—A systematic literature review. Part 1: Characteristics of the studies. *Int J Prosthodont* 2004;17:83-93.
- Strassburger C, Kerschbaum T. Einfluss der zahnärztlich prothetischen Therapie auf Patientenzufriedenheit und Lebensqualität—Systematischer Überblick. *Dtsch Zahnärztl Zeit* 2002;57:487-491.
- Acute Pain Management: Operative or Medical Procedures and Trauma. Rockville, MD: US Department of Health and Human Services, Agency for Health Care Policy and Research, 1992.
- Hakestam U, Soderfeldt B, Ryden O, Glantz E, Glantz P. Dimensions of satisfaction among prosthodontic patients. *Eur J Prosthodont Restorative Dent* 1997;5:111-117.
- Hakestam U, Karlsson T, Söderfeldt B, Ryden O, Glantz P. Does the quality of advanced prosthetic dentistry determine patient satisfaction? *Acta Odontol Scand* 1997;55:365-371.
- Hakestam U, Glantz E, Soderfeldt B, Glantz P. What do patients expect from extensive restorative dental treatment? *Eur J Prosthodont Restorative Dent* 1996;4:53-57.
- Locker D, Miller Y. Evaluation of subjective oral health status indicators. *J Public Health Dent* 1994;54:167-176.
- Awad M, Feine J. Measuring patient satisfaction with mandibular prostheses. *Community Dent Oral Epidemiol* 1998;26:400-405.
- Barenthin I. Dental health status and dental satisfaction. *Int J Epidemiol* 1977;6:73-79.
- Clancy J, Buchs A, Ardjmand H. A retrospective analysis of one implant system in an oral surgery practice. Phase I: Patient satisfaction. *J Prosthet Dent* 1991;65:265-271.
- Ettinger R, Jakobsen J. A comparison of patient satisfaction and dentist evaluation of overdenture therapy. *Community Dent Oral Epidemiol* 1997;25:223-227.
- Carlsson G, Otterland A, Wennström A. Patient factors in appreciation of complete dentures. *J Prosthet Dent* 1967;17:322-328.
- Bergman B, Carlsson G. Review of 54 complete denture wearers: Patients' opinions 1 year after treatment. *Acta Odontol Scand* 1972;30:399-414.
- Smith J, Sheiham A. How dental conditions handicap the elderly. *Community Dent Oral Epidemiol* 1979;7:305-310.
- Cushing A, Sheiham A, Maizels J. Developing socio-dental indicators—The social impact of dental disease. *Community Dent Health* 1986;3:3-17.

25. Heyink J, Schaub R. Denture problems and the quality of life in a Dutch elderly population. *Community Dent Oral Epidemiol* 1986;14:193-194.
26. Reisine S, Fertig J, Weber J, Leder S. Impact of dental conditions on patients' quality of life. *Community Dent Oral Epidemiol* 1989;17:7-10.
27. Petersen P, Nörtov B. General and dental health in relation to life-style and social network activity among 67-year-old Danes. *Scand J Prim Health Care* 1989;7:225-230.
28. Sheiham A, Steele J, Marcenes W, Tsakos G, Finch S, Walls A. Prevalence of impacts of dental and oral disorders and their effects on eating among older people: A national survey in Great Britain. *Community Dent Oral Epidemiol* 2001;29:195-203.
29. Smedley T, Friedrichsen S, Cho M. A comparison of self-assessed satisfaction among wearers of dentures, hearing aids, and eyeglasses. *J Prosthet Dent* 1989;62:654-661.
30. Schrenker H, Stark H. Mehr Lebensqualität für alte Menschen durch einen den gestiegenen bedürfnissen entsprechenden Zahnersatz. *Geriatric Forschung* 1996;6:177-184.
31. Frank RP, Milgrom P, Leroux BG, Hawkins NR. Treatment outcomes with mandibular removable partial dentures: A population-based study of patient satisfaction. *J Prosthet Dent* 1998;80:36-45.
32. Fenlon M, Sherriff M, Walter J. Association between the accuracy of intermaxillary relations and complete denture usage. *J Prosthet Dent* 1999;81:520-525.
33. Frank RP, Brudvik J, Leroux BG, Milgrom P, Hawkins NR. Relationship between the standards of removable partial denture construction, clinical acceptability, and patient satisfaction. *J Prosthet Dent* 2000;83:521-527.
34. Hoogstraten J, Lamers L. Patient satisfaction after insertion of an osseointegrated implant bridge. *J Oral Rehabil* 1987;14:481-487.
35. Fiske J, Davis D, Frances C, Gelbier S. The emotional effects of tooth loss in edentulous people. *Br Dent J* 1998;184:90-93, discussion 79.
36. van Waas M. Determinants of dissatisfaction with dentures: A multiple regression analysis. *J Prosthet Dent* 1990;64:569-572.
37. Wayler A, Chauncey H. Impact of complete dentures and impaired natural dentition on masticatory performance and food choice in healthy aging men. *J Prosthet Dent* 1983;49:427-433.
38. Atchison K, Dolan T. Development of the geriatric oral health assessment index. *J Dent Educ* 1990;54:680-687.
39. Strauss R, Hunt R. Understanding the value of teeth to older adults: Influences on the quality of life. *J Am Dent Assoc* 1993;124:105-110.
40. Slade G, Spencer A. Development and evaluation of the oral health impact profile. *Community Dent Health* 1994;11:3-11.
41. Slade G, Spencer A. Social impact of oral conditions among older adults. *Aust Dent J* 1994;39:358-364.
42. Slade G, Hoskin G, Spencer A. Trends and fluctuations in the impact of oral conditions among older adults during a one year period. *Community Dent Oral Epidemiol* 1996;24:317-321.
43. Allen P, McMillan A, Walshaw D, Locker D. A comparison of the validity of generic- and disease-specific measures in the assessment of oral health-related quality of life. *Community Dent Oral Epidemiol* 1999;27:344-352.
44. Allen P, McMillan A. The impact of tooth loss in a denture-wearing population: An assessment using the oral health impact profile. *Community Dent Health* 1999;16:176-180.
45. Luotio K, Turunen J, Hanhela M. Besser lachen und kauen; Implantate—Lebensqualität und Mundhygiene. *Implantol J* 2000;3:68-70.
46. Moroi H, Okimoto K, Terada Y. The effect of an oral prosthesis on the quality of life for head and neck cancer patients. *J Oral Rehabil* 1999;26:265-273.
47. Allison P, Locker D, Jokovic A, Slade G. A cross-cultural study of oral health values. *J Dent Res* 1999;78:643-649.
48. Locker D, Slade G. Oral health and the quality of life among older adults: The oral health impact profile. *J Can Dent Assoc* 1993;59:830-844.
49. Yoshida M, Sato Y, Akagawa Y, Hiasa K. Correlation between quality of life and denture satisfaction in elderly complete denture wearers. *Int J Prosthodont* 2001;14:77-80.
50. Berg E. A 2-year follow-up study of patient satisfaction with new complete dentures. *J Dent* 1988;16:160-165.
51. Pietrokovski J, Harfin J, Mostavoy R, Levy F. Oral findings in elderly nursing home residents in selected countries: Quality of and satisfaction with complete dentures. *J Prosthet Dent* 1995;73:132-135.
52. Micheelis W, Reich E. Dritte Deutsche Mundgesundheitsstudie (DMS III). Köln: IDZ Institut der Deutschen Zahnärzte, 1997:530.
53. Meeuwissen J. Perception of Oral function of Dentate Elderly [thesis]. Nijmegen: University of Nijmegen, 1992:113.
54. Kiyak H, Beach B, Worthington P, Taylor T, Bolender C, Evans J. Psychological impact of osseointegrated dental implants. *Int J Oral Maxillofac Implants* 1990;5:61-69.
55. Müller F, Wahl G, Fuhr K. Age-related satisfaction with complete dentures, desire for improvement and attitudes to implant treatment. *Gerodontology* 1994;11:7-12.
56. Tavares M, Branch L, Shulman L. Dental implant patients and their satisfaction with treatment. *J Dent Educ* 1990;54:670-679.
57. Sonoyama W, Kuboki T, Okamoto S, et al. Quality of life assessment in patients with implant-supported and resin-bonded fixed prosthesis for bounded edentulous spaces. *Clin Oral Implants Res* 2002;13:359-364.
58. Dervis E. Clinical assessment of common patient complaints with complete dentures. *Eur J Prosthodont Restorative Dent* 2002;10:113-117.
59. Ekfeldt A, Johansson L, Isaksson S. Implant-supported overdenture therapy: A retrospective study. *Int J Prosthodont* 1997;10:366-374.
60. Albrektsson T, Blomberg S, Branemark A, Carlsson G. Edentulousness—An oral handicap. Patient reactions to treatment with jawbone-anchored prostheses. *J Oral Rehabil* 1987;14:503-511.
61. van Waas M. The influence of clinical variables on patients' satisfaction with complete dentures. *J Prosthet Dent* 1990;63:307-310.
62. van Waas M, Meeuwissen J, Meeuwissen R, Kayser A, Kalk W, van't Hof M. Relationship between wearing a removable partial denture and satisfaction in the elderly. *Community Dent Oral Epidemiol* 1994;22:315-318.
63. van Waas M. The influence of psychologic factors on patient satisfaction with complete dentures. *J Prosthet Dent* 1990;63:545-548.
64. Chang M, Odman P, Wennstrom J, Andersson B. Esthetic outcome of implant-supported single-tooth replacements assessed by the patient and by prosthodontists. *Int J Prosthodont* 1999;12:335-341.
65. Harle T, Anderson J. Patient satisfaction with implant-supported prostheses. *Int J Prosthodont* 1993;6:153-162.
66. Locker D, Matear D, Stephens M, Jokovic A. Oral health-related quality of life of a population of medically compromised elderly people. *Community Dent Health* 2002;19:90-97.
67. Levine R, Clem D, Beagle J, et al. Multicenter retrospective analysis of the solid-screw ITI implant for posterior single-tooth replacements. *Int J Oral Maxillofac Implants* 2002;17:550-556.
68. Melas F, Marcenes W, Wright P. Oral health impact on daily performance in patients with implant-stabilized overdentures and patients with conventional complete dentures. *Int J Oral Maxillofac Implants* 2001;16:700-712.
69. Peltola M, Raustia A, Salonen M. Effect of complete denture renewal on oral health—A survey of 42 patients. *J Oral Rehabil* 1997;24:419-425.
70. Sato Y, Hamada S, Akagawa Y, Tsuga K. A method for quantifying overall satisfaction of complete denture patients. *J Oral Rehabil* 2000;27:952-957.

71. Humphris G, Healey T, Howell R, Cawood J. The psychological impact of implant-retained mandibular prostheses: A cross-sectional study. *Int J Oral Maxillofac Implants* 1995;10:437-444.
72. Wismeijer D, Vermeeren J, van Waas M. Patient satisfaction with overdentures supported by one-stage TPS implants. *Int J Oral Maxillofac Implants* 1992;7:51-55.
73. Vermeylen K, Collaert B, Linden U, Bjorn A, de Bruyn H. Patient satisfaction and quality of single-tooth restorations. *Clin Oral Implants Res* 2003;14:119-124.
74. Meijer H, Geertman M, Raghoebar G, Kwakman J. Implant-retained mandibular overdentures: 6-year results of a multicenter clinical trial on 3 different implant systems. *J Oral Maxillofac Surg* 2001;59:1260-1268, discussion 1269-1270.
75. de Baat C, van Aken A, Mulder J, Kalk W. "Prosthetic condition" and patients' judgment of complete dentures. *J Prosthet Dent* 1997;78:472-478.
76. Karabuda C, Tosun T, Ermis E, Ozdemir T. Comparison of 2 retentive systems for implant-supported overdentures: Soft tissue management and evaluation of patient satisfaction. *J Periodontol* 2002;73:1067-1070.
77. Stellingsma C, Raghoebar G, Meijer H, Batenburg R. Reconstruction of the extremely resorbed mandible with interposed bone grafts and placement of endosseous implants. A preliminary report on outcome of treatment and patients' satisfaction. *Br J Oral Maxillofac Surg* 1998;36:290-295.
78. Vervoorn J, Duinkerke A, Luteijn F, van de Poel A. Assessment of denture satisfaction. *Community Dent Oral Epidemiol* 1988;16:364-367.
79. Grogono A, Gardiner D, Finger I. Functional and psychological factors influencing patient attitudes towards implant prostheses. *Oral Health* 1997;87:15-18,21.
80. Grogono A, Lancaster D, Finger I. Dental implants: A survey of patients' attitudes. *J Prosthet Dent* 1989;62:573-576.
81. Gunay H, Veltmaat A, Schneller T, Neukam F. Psychologische Aspekte bei Patienten nach Implantatversorgung. *Deutsche Zahnärztliche Zeitschrift* 1991;46:21.
82. Kalk W, de Baat C. Patients' complaints and satisfaction 5 years after complete denture treatment. *Community Dent Oral Epidemiol* 1990;18:27-31.
83. Yi S, Carlsson G, Ericsson I, Wennstrom J. Long-term follow-up of cross-arch fixed partial dentures in patients with advanced periodontal destruction: Evaluation of occlusion and subjective function. *J Oral Rehabil* 1996;23:186-196.
84. John M, Micheelis W. Mundgesundheitsbezogene Lebensqualität in der Bevölkerung: Grundlagen und Ergebnisse des oral health impact profile (OHIP) aus einer repräsentativen Stichprobe in Deutschland. *IDZ-Information* 2003;1:1-28.
85. Wolff A, Gadre A, Begleiter A, Moskona D, Cardash H. Correlation between patient satisfaction with complete dentures and denture quality, oral condition, and flow rate of submandibular/sublingual salivary glands. *Int J Prosthodont* 2003;16:45-48.
86. Zlataric D, Celebic A. Treatment outcomes with removable partial dentures: A comparison between patient and prosthodontist assessments. *Int J Prosthodont* 2001;14:423-426.
87. Cune M, de Putter C, Hoogstraten J. Treatment outcome with implant-retained overdentures: Part II. Patient satisfaction and predictability of subjective treatment outcome. *J Prosthet Dent* 1994;72:152-158.
88. Kaptein M, Hoogstraten J, de PC, de LG, Blijdorp P. Dental implants in the atrophic maxilla: Measurements of patients' satisfaction and treatment experience. *Clin Oral Implants Res* 1998;9:321-326.
89. Geertman M, van Waas M, van't Hof M, Kalk W. Denture satisfaction in a comparative study of implant-retained mandibular overdentures: A randomized clinical trial. *Int J Oral Maxillofac Implants* 1996;11:194-200.
90. Gunne H-S. The effect of removable partial dentures on mastication and dietary intake. *Acta Odontol Scand* 1985;43:269-278.
91. Gunne H-S, Wall A-K. The effect of new complete dentures on mastication and dietary intake. *Acta Odontol Scand* 1985;43:257-268.
92. Watson R, Jemt T, Chai J, et al. Prosthodontic treatment, patient response, and the need for maintenance of complete implant-supported overdentures: An appraisal of 5 years of prospective study. *Int J Prosthodont* 1997;10:345-354.
93. de Grandmont P, Feine J, Tache R, et al. Within-subject comparisons of implant-supported mandibular prostheses: Psychometric evaluation. *J Dent Res* 1994;73:1096-1104.
94. Boerrigter E, Stegenga B, Raghoebar G, Boering G. Patient satisfaction and chewing ability with implant-retained mandibular overdentures: A comparison with new complete dentures with or without preprosthetic surgery. *J Oral Maxillofac Surg* 1995;53:1167-1173.
95. Tang L, Lund J, Tache R, Clokie C, Feine J. A within-subject comparison of mandibular long-bar and hybrid implant-supported prostheses: Psychometric evaluation and patient preference. *J Dent Res* 1997;76:1675-1683.
96. de Albuquerque R Jr, Lund J, Tang L, et al. Within-subject comparison of maxillary long-bar implant-retained prostheses with and without palatal coverage: Patient-based outcomes. *Clin Oral Implants Res* 2000;11:555-565.
97. Geertman M, Boerrigter E, Van't Hof M, et al. Two-center clinical trial of implant-retained mandibular overdentures versus complete dentures—Chewing ability. *Community Dent Oral Epidemiol* 1996;24:79-84.
98. Heydecke G, Boudrias P, Awad M, de Albuquerque R, Lund J, Feine J. Within-subject comparisons of maxillary fixed and removable implant prostheses. *Clin Oral Implants Res* 2003;14:125-130.
99. Kapur K, Garrett N, Hamada M, et al. A randomized clinical trial comparing the efficacy of mandibular implant-supported overdentures and conventional dentures in diabetic patients. Part I: Methodology and clinical outcomes. *J Prosthet Dent* 1998;79:555-569.
100. Naert I, Gizani S, van Steenberghe D. Rigidly splinted implants in the resorbed maxilla to retain a hinging overdenture: A series of clinical reports for up to 4 years. *J Prosthet Dent* 1998;79:156-164.
101. Garrett N, Kapur K, Perez P. Effects of improvements of poorly fitting dentures and new dentures on patient satisfaction. *J Prosthet Dent* 1996;76:403-413.
102. Boerrigter E, Geertman M, Van Oort R, et al. Patient satisfaction with implant-retained mandibular overdentures. A comparison with new complete dentures not retained by implants—A multicentre randomized clinical trial. *Br J Oral Maxillofac Surg* 1995;33:282-288.
103. de Bruyn H, Collaert B, Linden U, Bjorn A. Patient's opinion and treatment outcome of fixed rehabilitation on Brånemark implants. A 3-year follow-up study in private dental practices. *Clin Oral Implants Res* 1997;8:265-271.
104. Aust B. Zufriedene Patienten? Eine Kritische Diskussion von Zufriedenheitsuntersuchungen in der Gesundheitlichen Versorgung. Berlin: Wissenschaftszentrum Berlin für Sozialforschung, Forschungsgruppe Gesundheitsrisiken und Präventionspolitik, 1994:46.
105. Türp J, Heiss H. Lebensqualität bei alternden Menschen. *Zahnärztl Mitt* 1999;89 (22):62-67.
106. International Classification of Functioning, Disability and Health. Geneva: World Health Organization, 2001.
107. Slade GD. Derivation and validation of a short-form oral health impact profile. *Community Dent Oral Epidemiol* 1997;25:284-290.

108. Allen F, Locker D. A modified short version of the oral health impact profile for assessing health-related quality of life in edentulous adults. *Int J Prosthodont* 2002;15:446-450.
109. Allen P, McMillan A, Locker D. An assessment of sensitivity to change of the oral health impact profile in a clinical trial. *Community Dent Oral Epidemiol* 2001;29:175-182.
110. Zitzmann N, Marinello C. Treatment outcomes of fixed or removable implant-supported protheses in the edentulous maxilla. Part I: Patients' assessments. *J Prosthet Dent* 2000;83:424-433.
111. Awad M, Locker D, Korner-Bitensky N, Feine J. Measuring the effect of intraoral implant rehabilitation on health-related quality of life in a randomized controlled clinical trial. *J Dent Res* 2000;79:1659-1663.
112. Burns D, Unger J, Elswick RJ, Giglio J. Prospective clinical evaluation of mandibular implant overdentures: Part II—Patient satisfaction and preference. *J Prosthet Dent* 1995;73:364-369.
113. Bouma J, Boerrigter L, Van Oort RP, van Sonderen E, Boering G. Psychosocial effects of implant-retained overdentures. *Int J Oral Maxillofac Implants* 1997;12:515-522.
114. Naert I, Gizani S, Vuylsteke M, van Steenberghe D. A randomized clinical trial on the influence of splinted and unsplinted oral implants in mandibular overdenture therapy. A 3-year report. *Clin Oral Invest* 1997;1:81-88.
115. Naert I, Gizani S, Vuylsteke M, van Steenberghe D. A 5-year prospective randomized clinical trial on the influence of splinted and unsplinted oral implants retaining a mandibular overdenture: Prosthetic aspects and patient satisfaction. *J Oral Rehabil* 1999;26:195-202.
116. Meijer H, Raghoobar G, van't Hof M, Geertman M, Van Oort RP. Implant-retained mandibular overdentures compared with complete dentures: A 5-years' follow-up study of clinical aspects and patient satisfaction. *Clin Oral Implants Res* 1999;10:238-244.
117. Wismeijer D, van Waas M, Vermeeren J, Mulder J, Kalk W. Patient satisfaction with implant-supported mandibular overdentures. A comparison of three treatment strategies with ITI-dental implants. *Int J Oral Maxillofac Implants* 1997;26:263-267.
118. Blomberg S, Lindquist L. Psychological reactions to edentulousness and treatment with jawbone-anchored bridges. *Acta Psychiatr Scand* 1983;68:251-262.
119. Blomberg S. Psychiatric aspects of patients treated with bridges on osseointegrated fixtures. *Swed Dent J Suppl* 1985; 28:183-192.
120. Allen P, McMillan A, Walshaw D. A patient-based assessment of implant-stabilized and conventional complete dentures. *J Prosthet Dent* 2001;85:141-147.
121. Fenlon M, Palmer R, Palmer P, Newton J, Sherriff M. A prospective study of single stage surgery for implant supported overdentures. *Clin Oral Implants Res* 2002;13:365-370.
122. Cibirka R, Razzoog M, Lang B. Critical evaluation of patient responses to dental implant therapy. *J Prosthet Dent* 1997;78:574-581.
123. Gregory M, Murphy W, Scott J, Watson C, Reeve P. A clinical study of the Brånemark dental implant system. *Br Dent J* 1990;168:18-23.
124. Davis D, Packer M. Mandibular overdentures stabilized by Astra Tech implants with either ball attachments or magnets: 5-year results. *Int J Prosthodont* 1999;12:222-229.
125. Walton J, MacEntee M, Glick N. One-year prosthetic outcomes with implant overdentures: A randomized clinical trial. *Int J Oral Maxillofac Implants* 2002;17:391-398.
126. Pera P, Bassi F, Schierano G, Appendino P, Preti G. Implant anchored complete mandibular denture: Evaluation of masticatory efficiency, oral function and degree of satisfaction. *J Oral Rehabil* 1998;25:462-467.
127. Kent G, Johns R. Effects of osseointegrated implants on psychological and social well-being: A comparison with replacement removable protheses. *Int J Oral Maxillofac Implants* 1994;9:103-106.
128. Kapur K. Veterans Administration Cooperative Dental Implant Study—Comparisons between fixed partial dentures supported by Blade-Vent implants and removable partial dentures. Part IV: Comparisons of patient satisfaction between two treatment modalities. *J Prosthet Dent* 1991;66:517-530.
129. Yi S, Carlsson G, Ericsson I, Kim C. Patient evaluation of treatment with fixed implant-supported partial dentures. *J Oral Rehabil* 2001;28:998-1002.
130. Kuboki T, Okamoto S, Suzuki H, et al. Quality of life assessment of bone-anchored fixed partial denture patients with unilateral mandibular distal-extension edentulism. *J Prosthet Dent* 1999;82:182-187.
131. Feine J, Dufresne E, Boudrias P, Lund J. Outcome assessment of implant-supported protheses. *J Prosthet Dent* 1998;79:575-579.
132. Cooper H, Hedges L. *The Handbook of Research Synthesis*. Newbury Park, CA: Russell Sage Foundation, 1994.
133. Feine J, Carlsson G, Awad M, et al. The McGill consensus statement on overdentures. Mandibular two-implant overdentures as first choice standard of care for edentulous patients. *Eur J Prosthodont Restorative Dent* 2002;10:95-96.
134. Feine J, Carlsson G, Awad M, et al. The McGill consensus statement on overdentures. Montreal, Quebec, Canada. May 24-25, 2002. *Int J Prosthodont* 2002;15:413-414.
135. Owen PC. Appropriatech: Prosthodontics for the many, not just for the few. *Int J Prosthodont* 2004;17:261-262.

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