

Dental Implants in Reconstructed Jaws: Patients' Evaluation of Functional and Quality-of-Life Outcomes

Albert C. F. Leung, BDS, MPhil, MDS, MOSRCS, FRACDS, FCDSHK(OMS)¹/
Lim K. Cheung, BDS, FDSRCPS, FFDRCS, FRACDS, FRACDS(OMS), FHKAM(DS), FCDSHK(OMS), PhD²

Purpose: To evaluate the quality-of-life aspect of treatment outcome following functional jaw reconstruction and dental implants in the maxilla or mandible. **Materials and Methods:** This cross-sectional study used a questionnaire interview of 28 rehabilitated patients who received autogenous bone grafts from the ilium and endosseous implants (14 maxillary and 14 mandibular cases; 134 implants) for functional jaw reconstruction between 1988 and 1999. A questionnaire was developed to assess the quality-of-life outcome for those patients who had finished their rehabilitation at least 6 months prior to the interview. Responses to the questions were recorded by means of visual analog scales. **Results:** In general, patients gave positive comments on the restoration of their orofacial appearance and function (mastication and speech). The majority (85.7%) found no problem in various daily social activities, including dining in public. **Discussion:** The overall level of satisfaction with the treatment outcome and the degree of recommendation of the treatment to others were both favorable (mean scores 8.6 and 8.7 out of 10, respectively). **Conclusion:** Oral rehabilitation using functional jaw reconstruction can reach a satisfactory level of esthetics, function, and psychosocial well being of patients, thus improving their quality of life. (INT J ORAL MAXILLOFAC IMPLANTS 2003;18:127-134)

Key words: dental implants, jaw, quality of life, reconstructive surgical procedures, treatment outcome

Abblative surgery of the jaws can result in significant cosmetic deformity, functional impairment, and psychologic sequelae to the patient. Because of the mutilating and incapacitating nature of the surgical defect, reconstruction of the maxilla and mandible remains a challenge to the surgical team. Over the past few decades, advances in a variety of surgical sciences have revolutionized surgical reconstruction of the oral and maxillofacial region.¹ The state-of-art reconstruction is to restore the structural integrity of maxillary and mandibular defects, including an alveolar ridge of appropriate dimension and form. Rehabilitation of oral function can be accomplished with the placement of

endosseous implants to support dental prostheses with improved stability and retention. This concept of reconstruction of lost tissues to allow restoration of the associated functions of the upper aerodigestive tract, such as mastication, speech, and swallowing, is known as *functional reconstruction*²; satisfactory results have been published in a number of case reports and clinical studies.²⁻⁶

Evaluations of treatment outcomes by surgeons do not necessarily correspond to patients' own judgment. This is because in most instances, patients are mostly concerned with factors such as comfort, function, and esthetics. When a patient's level of expectation of the treatment outcome is not reached, unfavorable emotional responses such as worry, anxiety, diminished self-esteem, and introversion can arise and directly affect daily functions and social activities, such that ultimately, their quality of life will be affected.⁷⁻⁹ Unfortunately, many clinicians have remarked on the difficulty and confusion they felt when asked to deal with the measurement of parameters associated with patient quality of life, which has been largely ignored to date.¹⁰

¹Dental Officer, Department of Health, Hong Kong.

²Professor of Oral and Maxillofacial Surgery, Faculty of Dentistry, University of Hong Kong, Hong Kong.

Reprint requests: Dr Lim K. Cheung, Discipline of Oral and Maxillofacial Surgery, Prince Philip Dental Hospital, University of Hong Kong, 34 Hospital Road, Hong Kong SAR, China. Fax: +852-2559-9014. E-mail: lkcheung@hkucc.hku.hk

Table 1 Areas of Quality-of-Life Domain in the Questionnaire

Domain	No. of questions included
Comfort	3
Function	3
Sense of belonging	1
Esthetics	1
Self-image	1
Social well-being	1
Satisfaction	2
Total	12

The importance of quality-of-life measurement is gaining increasing awareness. In 1993, the World Health Organization defined "quality of life" as "an individual's perception of his position in life in the context of the culture and value systems in which he lives and in relation to his goals, expectations, standards, and concerns."¹¹ Within the same year, in defining the outcomes of cancer treatment for the assessment of technology and development of treatment guidelines, the Outcomes Working Group of the American Society of Clinical Oncology ascertained quality of life as an important patient outcome of cancer treatment and elucidated its physical, psychological, social, and global dimensions.¹² In the context of surgical practice, the quality of life considers the psychosocial impact of treatment, whether positive or negative, on certain dimensions of the patient's life. Its measurement can enhance the assessment of the patient's health status and is useful in the appraisal of the therapeutic interventions.¹³ Researchers and clinicians are now more ready to include quality of life as a measurement parameter in their studies. While "quality of life" has been a separate keyword heading in the Index Medicus for more than 20 years, the number of articles categorized under it continues to increase every year. From 1994 to 1997, almost 9,800 published articles were concerned with this concept.¹⁴ In oral and maxillofacial surgery, head and neck oncology has been among the few subjects presenting studies on quality-of-life aspects of patient treatment since the early 1980s.¹⁴⁻¹⁶

While jaw ablation itself has a profound psychological impact on patients, rehabilitation after jaw reconstruction also requires both functional and psychosocial adaptation by the patients. However, at present, most data on the outcomes of functional jaw reconstruction are concerned with its technical and clinical dimensions. To the authors' knowledge, there is no specific study on patients' perception of the functional or psychosocial benefits or the other outcomes of this form of treatment.

The present study aims to establish some reliable and valid patient-based evidence of treatment outcome using dental implants in reconstructed jaws following ablative surgery. Furthermore, it is the intention of this study to understand the effect of functional jaw reconstruction on patients' quality of life, to obtain some baseline data about the psychosocial impact of jaw ablation and reconstruction on the patients, and to assist in the development of success criteria for reconstructive jaw surgery.

MATERIALS AND METHODS

The clinical records of all patients under the care of the Discipline of Oral and Maxillofacial Surgery, Faculty of Dentistry, University of Hong Kong, who had been treated with osseointegrated implants between the years 1988 and 1999 were reviewed. All subjects who received functional reconstruction of the maxilla or mandible after jaw resection were identified for assessment. They were then contacted by phone and invited to attend a scheduled appointment.

Reconstruction Protocol

After surgical resection, primary or secondary reconstruction of the maxilla or mandible was performed with an autogenous bone graft harvested from the ilium with the inclusion of allogenic (such as bone morphogenetic protein) and/or alloplastic (such as Dacron [Osteo-mech, Xomed, Jacksonville, FL] or titanium mesh tray) grafting.² Adjunctive procedures were done when indicated; this included the harvesting of intraoral local flaps (the buccal fat pad or palatal flap) or extraoral regional flaps (the temporalis or pectoralis major muscle flap) for soft tissue coverage of the osseous graft complex and nerve reconstruction with sural nerve or greater auricular nerve graft. Reconstruction was finally accomplished with the subsequent placement of osseointegrated implants for the support of fixed prostheses or overdentures. Where necessary, pre-implant surgical procedures, such as osteotomy, vestibuloplasty, or mucosal grafting, were performed.

Methods

Development of Questionnaire. After a comprehensive review of the existing literature on the reporting or measurement of patients' responses to rehabilitation after ablative jaw surgery, a list of constructs to be studied was prepared (Table 1). Despite the availability of a number of measuring tools,^{17,18} it was decided to develop a questionnaire specifically for Asian patients, who have special cultural habits and beliefs deemed to be different from those of Western patients.

The design of the questionnaire was meant to be brief and easy to understand and complete. It provided for the recording of concise demographic data followed by 12 questions to evaluate the respondent's subjective feelings on various perspectives (Fig 1). The questionnaire was drafted in English and translated into Chinese for completion by the participants. Responses to most questions were recorded by visual analog scales. Each scale consisted of a 10-cm line representing a spectrum of feeling from zero to the top end of the scale. Each participant completed a questionnaire under supervision.

Exclusion Criteria. Patients at less than 6 months after rehabilitation incorporating a functional implant-supported prosthesis and those who presented with psychologic contraindications to a questionnaire study, as suggested by Bloomberg,¹⁹ were excluded from the study. The latter may include psychotic or neurotic syndromes, presenile dementia, syndromes of cerebral lesions, and alcohol or drug abuse.

Statistical Analysis. All data were entered into the computer and analysis was carried out using the software InStat™ (Version 3.0, GraphPad Software, San Diego, CA) in Windows 98 (Microsoft, Redmond, WA). Descriptive statistics of the study sample were made. Differences between opposite gender or between relevant groups were tested by Wilcoxon rank sum test for different categorical variables. Correlation analysis between parameters was performed with linear regression (regression coefficient r) or the Student t test, as indicated. The statistical significance level was set at 5%.

RESULTS

From January 1988 to December 1999, a total of 46 cases of maxillary and mandibular reconstruction followed by placement of dental implants were identified (Table 2). Twenty-eight patients who were at 6 months or more after rehabilitation were eventually included in the questionnaire study.

Demographic Data of Participants

Among the 28 patients, there were 17 men and 11 women. The male-to-female ratio was 1.55:1. The age of the patients ranged from 14 to 66 years (mean 35.8 ± 14.7 years, median 34.0 years) and the largest group of patients was between 21 and 30 years. All patients were ethnic Chinese. About two thirds of the participants (64.2%) had a full-time or part-time job and 25.0% were the primary financial supporters of their families.

1. How stable is the existing implant-supported prosthesis inside your mouth?
2. To what extent can you chew as freely as you like?
3. The following are food examples requiring different chewing effort. Which of them will you avoid because of chewing difficulty? (eg, nuts, meat, vegetables, fish, etc)
4. How is your speech quality now when compared with that before treatment?
5. Is the implant-supported prosthesis giving you any pain or discomfort?
6. If you answer to question 5 is "Yes," what is the degree?
7. To what extent do you feel that the reconstructed jawbone and implant-supported prosthesis inside your mouth to be a part of your body?
8. To what extent is your facial appearance restored or improved by the reconstructed jawbone and the implant-supported prosthesis?
9. How will you grade your self-image in relation to the following different time periods during the course of treatment?
10. Currently, do you feel mentally comfortable or confident to take part in the following family/social activities?
11. Suppose one of your relatives requires similar treatment and asks for your opinion before the operation. What degree of recommendation will you give?
12. In general, what is the degree of satisfaction of the present treatment outcome of the reconstructed jawbone with its implant-supported prosthesis?

Fig 1 List of questions posed to study participants.

Table 2 Profile of Functional Reconstruction Patients

Status	No. of patients
Rehabilitation completed	
6 months or more*	28
Less than 6 months	1
Not interested in study	3
Treatment in progress (pending stage 2 implant surgery)	4
Failed case	4
Residing outside Hong Kong	3
Deceased/lost contact	3
Total	46

*Participated in study.

Surgical Data

Among the 28 patients, the number of maxillary and mandibular reconstructions was equal. There were 16 primary and 12 secondary reconstructions. All patients received non-vascularized autogenous bone grafts, with 23 subjects (82.1%) receiving a titanium mesh tray and the remaining 5 (17.9%) involving Dacron tray reconstruction. In all patients, bone was harvested from the ilium. Odontogenic tumors (64.3%) were the most prevalent pathology; among these, there were 13 cases of ameloblastoma

Table 3 Outcomes with Dental Implant Systems Used

Implant system	No. of patients (%)	Implants osseointegrated (%)	Implants failed (%)	Nonfunctioning implants (%)	Total
Brånemark	10 (39.3)	44 (95.7)	2 (4.3)	1 (2.1)	46
IMZ	14 (50.0)	67 (97.1)	2 (2.9)	5 (7.2)	69
Calcitek	4 (10.7)	17 (89.5)	2 (10.5)	1 (5.3)	19
Total	28	128 (95.6)	6 (4.5)	7 (5.2)	134

Table 4 Summary of Scores on Different Parameters

Parameter	Score	
	Mean	Range
Freedom of chewing	8.3 ± 1.5	4.7–10.0
Speech	8.2 ± 2.0	2.9–10.0
Stability of prosthesis	8.3 ± 2.0	1.7–10.0
Sense of body part (jaw)	8.4 ± 1.6	4.9–10.0
Sense of body part (prosthesis)	6.7 ± 2.9	0.3–10.0
Esthetics (jaw)	8.0 ± 2.1	2.4–10.0
Esthetics (prosthesis)	7.2 ± 2.8	0.1–10.0
Recommendation	8.7 ± 2.2	0.1–10.0
Satisfaction	8.6 ± 1.9	2.7–10.0

(72.2%), 3 myxoma cases (16.6%), 1 case of ameloblastic fibro-odontoma (5.6%), and 1 adenomatoid odontogenic tumor (5.6%). Nerve reconstruction using micro-anastomosis was performed in 21.4% of the patients, and 60.7% of patients received additional pre-implant surgeries.

Implant and Prosthodontic Data

A total of 134 implants were placed in the 28 patients, and the mean duration after reconstruction for stage 1 implant surgery was 13.2 months (range, 6 to 38 months). Three implant systems were used: the Brånemark System (Nobel Biocare, Göteborg, Sweden); the IMZ System (Interpore International, Irvine, CA); and the Calcitek System (Sulzer, Carlsbad, CA). Table 3 summarizes the distribution and outcomes of the different systems of implants placed. The mean duration of uncovering of the implants after placement was 6.6 months (range, 5 to 9 months). Osseointegration was found to be clinically and radiographically achieved in 95.6% of the 134 implants placed. If the 7 non-functional implants were considered as failures, the survival rate became 90.3%.

Of the 28 prostheses, 23 were fixed prostheses and 5 were overdentures. The mean time in function for the prostheses was 50 months (range, 14 to 103 months). Regarding the opposing occlusion, natural teeth were found in 67.9% of subjects, and the remaining 32.1% presented with removable or fixed prostheses.

Table 5 Situations that Presented Psychosocial Difficulties for 4 Respondents

Circumstances	No. of responses*
Home dining with family	0
Gathering with relatives and friends	1
Getting along with working associates	1
Entertainment in the streets	1
Dining with relatives and friends	2
Attending parties and banquets	3

*Respondents who said that these situations did present difficulties for them.

The Questionnaire

Table 4 summarizes the average scores of the 28 patients for various parameters. In general, most parameters were given a score of 8.0 or above (out of 10); and comparatively, the reconstructed jaw gained a higher score from the patients than the implant-supported prosthesis, in terms of both the sense of being a part of the body (8.4 versus 6.7) and esthetics (8.0 versus 7.2).

Food Consistency. Nine subjects (4 men and 5 women, 5 maxillae and 4 mandibles; 32.1% of subjects overall) claimed no limitation in the consistency of food they could take. Nuts were found to be difficult for 28 subjects (46.4%) and this was followed by meat (17.9%).

Discomfort. Eight subjects (3 men and 5 women, 1 maxilla and 7 mandibles; 28.6% of subjects overall) claimed some degree of discomfort from the existing prosthesis. The average score of these 8 subjects was 3.7 (range 1.0 to 5.8).

Social Well-being. The majority of questionnaire respondents (85.7%) found no problem with adaptation to the various social circumstances described in the questionnaire. For the remaining 4 respondents, Table 5 illustrates the situations that caused psychosocial difficulty for these patients. Accordingly, attending parties and banquets caused disturbance to most of them.

Gender, Age, and Jaw Differences. Analyses of results between the male and female respondents, as

Table 6 Analysis of Scores Based on Gender

Parameter	Mean score		P value
	Male	Female	
Freedom of chewing	8.1 ± 1.4	8.6 ± 1.9	> .1
Speech	7.9 ± 2.1	8.7 ± 1.9	> .05
Stability of prosthesis	7.8 ± 2.2	9.1 ± 1.3	< .05*
Sense of body part (jaw)	8.4 ± 1.3	8.4 ± 1.9	> .1
Sense of body part (prosthesis)	7.2 ± 2.7	6.0 ± 3.3	> .1
Esthetics (jaw)	7.6 ± 2.3	8.5 ± 1.5	> .1
Esthetics (prosthesis)	7.0 ± 3.0	7.6 ± 2.6	> .5
Recommendation	8.6 ± 2.4	9.0 ± 1.9	> .1
Satisfaction	8.8 ± 1.6	8.4 ± 2.3	> .5

*Statistically significant, Mann-Whitney *U* test.

Table 7 Analysis of Scores Based on Maxillary and Mandibular Jaws

Parameter	Mean score		P value*
	Maxilla	Mandible	
Freedom of chewing	8.9 ± 1.0	7.7 ± 1.8	> .05
Speech	8.5 ± 1.9	8.0 ± 2.1	> .5
Stability of prosthesis	8.4 ± 2.1	8.2 ± 1.3	< .5
Sense of body part (jaw)	8.8 ± 1.4	8.0 ± 1.7	> .1
Sense of body part (prosthesis)	7.9 ± 1.8	5.5 ± 3.4	> .05
Esthetics (jaw)	8.0 ± 2.3	7.9 ± 1.8	> .1
Esthetics (prosthesis)	7.2 ± 3.2	7.3 ± 2.5	> .5
Recommendation	9.1 ± 1.2	8.5 ± 2.9	> .5
Satisfaction	9.0 ± 1.2	8.2 ± 2.3	> .5

*All non-significant, Mann-Whitney *U* test.

Table 8 Correlation analysis of Scores and Patient Ages

Parameter	Regression coefficient		P value*
	<i>r</i>	<i>r</i> ²	
Freedom of chewing	-0.1879	0.0353	> .1
Speech	0.0879	0.0077	> .5
Stability of prosthesis	-0.2122	0.0450	> .1
Sense of body part (jaw)	-0.2306	0.0532	> .1
Sense of body part (prosthesis)	-0.3340	0.1116	> .05
Esthetics (jaw)	-0.1258	0.0158	> .5
Esthetics (prosthesis)	0.0856	0.0073	> .5
Recommendation	-0.1568	0.0246	> .1
Satisfaction	-0.3118	0.0972	> .1

*All non-significant.

well as the maxillary and mandibular cases, are summarized in Tables 6 and 7. No significant difference was revealed with regard to gender or maxilla versus mandible, except regarding the stability of the prosthesis, where female respondents gave higher scores than the male subjects (9.1 versus 7.8, $P < .05$).

The scores of the different parameters were further analyzed in relation to the ages of the patients using regression analysis. None of these analyses revealed a significant result (Table 8).

DISCUSSION

The present study was conceived to explore and develop a proper instrument to describe the treatment outcome of patients following functional jaw reconstruction with regard to their quality of life. Currently, assessment of the quality of life has become an essential consideration in evaluation of the effects of a disease and its treatment outcome. However, the majority of the literature has been

associated with life quality following cancer resection, rather than the outcome of surgical rehabilitation.¹⁴ In a recent pertinent review on measuring tools of quality of life, Sloan and coworkers²⁰ suggested that the current instruments for patients with maxillofacial implant-supported prostheses were insufficiently targeted and developed. They have been criticized for lack of questions specific to the particular problems of a disease or condition.

Because existing information on the psychosocial aspects of patients following functional jaw reconstruction is limited and empirical, a specific questionnaire was designed for the current study to obtain baseline data and identify areas of interest and concern associated with the rehabilitated patients. The questions in the questionnaire were formulated after surveying the related literature. After the questionnaire was drafted, it was given to a few professional and non-professional associates of the authors for pre-testing. Any ambiguous questions were identified and amended. These ensured the inclusion of various health dimensions that were expected to be found in a quality-of-life questionnaire, as advocated.^{13,21} They include physical, psychologic, social, and performance status of the patient. Additionally, a visual analog scale was used in the questionnaire to record patient responses to the parameter assessed. When compared with categorical grading (such as "very much," "somewhat," "a little," or "not at all"), the visual analog scale can give a greater degree of differentiation in scoring, and a number of authors have substantiated the reliability and accuracy of data obtained from such self-rating scales.^{22,23}

The study sample of 28 patients may seem small for a quality-of-life assessment study. However, it should be noted that each patient received a series of operations, including jaw resection, reconstruction, implant surgery in 2 stages, and vestibuloplasty, before they could be included in the sample. So each patient was exceptional in reaching the criteria for inclusion, even in large reconstructive surgical centers. A proportion of dropouts was to be expected because of death, failure to make contact, and unwillingness to come for evaluation. Moreover, patients who had completed their surgical-prosthetic rehabilitation less than 6 months before the study began were not included in the study. In any case, after half a year, any initial enthusiasm probably would have disappeared. Thus, the response obtained, whether positive or negative, should be a reflection of the stable opinion and experience of the respondents after "living" with their reconstructed jaws and implant-supported prostheses for a reasonable period. This criterion was believed to enhance the reliability of the data obtained.

The profile of the studied patient population was quite different from most published series in the existing literature. In the present study, the pathologic spectrum was principally associated with locally aggressive odontogenic tumors. Resection of the afflicted maxillofacial area mainly involved the loss of osseous and dental structures with less extensive soft tissue sacrifice. Since the degree and location of soft tissue resection can have a significant impact on postoperative oropharyngeal functions,²⁴ to some extent, this also has an effect on the functional outcome of the patients after treatment.

The ability to chew and enjoy food after jaw ablation can have profound implications for lifestyle and social interactions, particularly for Chinese. Loss of eating abilities may lead to depression and frustration. In a study of the postsurgical morbidity of 50 patients following major head and neck surgery, Vaughan reported that 80% of a patient population experienced difficulty with mastication and salivary control.²⁵ These problems were felt to be contributory factors in preventing normal social adaptation and return to a normal occupation. In assessing a sample of 181 head and neck cancer patients at 4 years after operation, List and coworkers found that only one third of them were willing to dine in public.²⁶ Incapacitating problems encountered by the patients included increased eating time, untidy food manipulation and consumption, the need for special food preparation, and oral incontinence. Finlay stated that lack of ability to chew and enjoy food, whether at home with family or in public with friends, is a factor in the development and progression of depression.²⁷ Patients feel uneasy or even unwilling to dine in public because they are afraid of causing embarrassment to themselves or their friends. The majority of the 28 subjects (89.3%) in this study experienced no difficulty with participation in social activities that involved eating in public, namely dining with friends and relatives or attending parties and banquets. While the study population reported a reasonable degree of chewing freedom (mean score 8.3), the majority (82.1%) could take different varieties of food, including meat and vegetables. These are common ingredients of the daily diet and can add nutrition and pleasure to the process of food intake.

It is believed that when speech and verbalization are involved, the issues relating to the quality of life can be quite dramatic, especially for those patients who have undergone radical resection involving glossectomy or total laryngectomy.²⁸ Chaturvedi and colleagues remarked that the loss of ability to control speech could lead to tension and frustration.²⁹ Accordingly, speech can serve an emotional function in maintenance of psychologic equilibrium during periods of

acute stress. Furthermore, postoperative interactions tend to become limited quantitatively. Thus, the abilities and opportunities of patients to express themselves, such as their intrinsic feeling or fear, might be restricted, and this could lead to frustration.

One factor that may affect both masticatory and speech functions is the lack of tongue mobility after surgery. This is particularly evident in patients having resective surgery involving the anterior mandible and the floor of the mouth. Even in the presence of a well-restored dentition or well-fabricated implant-supported prosthesis, these patients may still complain of inefficient mastication or unclear speech.²⁷ During reconstruction, consideration should be given to optimize the functional capacity of the residual tongue.

The reconstructed jaws and implant prostheses were "well-accepted" as "part of themselves" by most patients in this study. Such a positive attitude toward implant-supported prostheses has been well-documented in the literature among edentulous patients.^{18,19,30} To some extent, this was an indirect indication of a successful treatment outcome: when patients considered the reconstructed jaws and dentitions as an integral part of their bodies, they implied that they would feel more confident in daily situations, leading to further improvement in their quality of life. The 28 patients generally gave higher scores to the reconstructed jaws than the implant-supported prostheses (8.4 versus 6.7) in this study. This may be related to the fact that the jawbone has a direct influence on orofacial contour, and the psychologic impact of jaw ablation is greater than the loss of teeth.

The overall satisfaction with the treatment outcome in this study was considered good (mean score of 8.6 out of 10). The satisfaction level of the 28 patients might be further revealed by their willingness to recommend the procedure to others requiring similar treatment (mean score 8.7). While these findings did substantiate the pervasive advantages and patient acceptance of functional jaw reconstruction, it is possible that the cultural characteristics of courtesy among the Chinese people and the close relationship between the patient and clinician might have prompted the patients to give more favorable responses to the questions. Additionally, most of those who consented to participate in the study were the most satisfied of the patients who had received the treatment. Nevertheless, while it is difficult to determine the tendency of any volunteering participants to be biased, it has to be admitted that in general, the responses to the questions were positive and appeared to correspond to a satisfactory treatment outcome.

The results revealed no difference in treatment outcome between the men and women or between the maxillary and mandibular cases, except that the female subjects gave generally higher scores to the stability of the implant-supported prosthesis than the males (9.1 versus 7.8, $P < .05$; Table 6). One possible explanation may be related to a greater degree of intraoral proprioception among the female subjects. An alternative reason may be related to the differences in dietary habit between the different genders. Broadly speaking, women tend to have greater awareness and concern relative to their orofacial health status and are more ready to restrict themselves from unfavorable dietary factors when needed.

Analysis of the data demonstrated no age difference in the treatment outcome. It is generally believed that with advancing age, there is a progressive reduction in the success rate of the functional level that can be achieved, and age-related impairment in myodynamics and proprioceptive adaptation may be contributing factors.³¹ The findings in relation to age difference may also be the result of the small sample size of the elder age group (5 subjects within the range 51 to 70 years). A study of a larger sample size with relatively more elderly patients would be useful to clarify this factor.

CONCLUSION

The present study revealed that in general, the patients demonstrated positive results when assessing their quality-of-life outcomes after functional jaw reconstruction. The majority of patients felt comfortable with their daily living and variety of common social activities. Their own evaluation of the esthetic and functional status was reasonable. The overall satisfaction level of the patients with the treatment outcome was high. Based on patients' own evaluation, oral rehabilitation using functional jaw reconstruction achieved not only a satisfactory level of esthetics and function in this patient population but also the psychosocial well-being of the patients, thus improving their quality of life.

REFERENCES

1. Marx RE. Mandibular reconstruction. *J Oral Maxillofac Surg* 1993;51:466-479.
2. Tideman H, Samman N, Cheung LK. Functional reconstruction of the mandible: A modified titanium mesh system. *Int J Oral Maxillofac Surg* 1998;27:339-345.

3. Schwartz MH, Drew SJ, Sachs SA. Osseous reconstruction following treatment of head and neck tumors. *Oral Maxillofac Surg Clin North Am* 1997;9:489–509.
4. Misiek DJ, Chang AK. Implant reconstruction following removal of tumors of the head and neck. *Oral Maxillofac Surg Clin North Am* 1997;9:511–543.
5. Keller EE, Tolman D, Eckert S. Endosseous implant and autogenous bone graft reconstruction of mandibular discontinuity: A 12-year longitudinal study of 31 patients. *Int J Oral Maxillofac Implants* 1998;13:767–780.
6. Weischer T, Mohr C. Ten-year experience in oral implant rehabilitation of cancer patients: Treatment concept and proposed criteria for success. *Int J Oral Maxillofac Implants* 1999;14:521–528.
7. Guckes AD, Smith DE, Swoope CC. Counseling-related factors influencing satisfaction with dentures. *J Prosthet Dent* 1978;39:259–267.
8. Friedman N, Landesman HM, Wexler M. The influences of fear, anxiety and depression on the patient's adaptive responses to complete dentures. Part III. *J Prosthet Dent* 1988;59:169–173.
9. Kalk W, van Waas MA, Engels SE. A comparison of different treatment strategies in patients with atrophic mandibles: A clinical evaluation after 6.5 years. *Int J Prosthodont* 1992; 5:277–283.
10. Hunt SM, McEwen J, McKenna SP. Measuring health status: A new tool for clinicians and epidemiologists. *J R Coll Gen Pract* 1985;35:185–188.
11. World Health Organization Quality of Life Group. Study protocol for the World Health Organization project to develop a quality of life assessment instrument. *Qual Life Res* 1993;2:143–159.
12. American Society of Clinical Oncology. Outcomes of cancer treatment for technology assessment and cancer treatment guidelines. *J Clin Oncol* 1996;2:671–679.
13. Fraser SCA. Quality-of-life measurement in surgical practice. *Br J Surg* 1993;80:163–169.
14. Rogers SN, Fisher SE, Woolgar JA. A review of quality of life assessment in oral cancer. *Int J Oral Maxillofac Surg* 1999;28:99–117.
15. Drettner B, Ahlboom A. Quality of life and state of health for patients with cancer in the head and neck. *Acta Otolaryngol* 1983;96:307–314.
16. Pruyt JF, de Jong PC, Bosman LJ, et al. Psycho-social aspects of head and neck cancer—A review of the literature. *Clin Otolaryngol* 1986;11:469–474.
17. Tolman DE, Taylor PF. Bone-anchored craniofacial prosthesis study. *Int J Oral Maxillofac Implants* 1996;11:159–168.
18. Kiyak HA, Beach BH, Worthington P, Taylor T, Bolender C, Evans J. The psychological impact of osseointegrated implants. *Int J Oral Maxillofac Implants* 1990;5:61–69.
19. Blomberg S. Psychological response. In: Brånemark P-I, Zarb G, Albrektsson T (eds). *Tissue-Integrated Prostheses. Osseointegration in Clinical Dentistry*. Chicago: Quintessence, 1985:165–174.
20. Sloan JA, Tolman DE, Anderson JD, Sugar AW, Wolfaardt JF, Novotny P. Patients with reconstruction of craniofacial or intraoral defects: Development of instruments to measure quality of life. *Int J Oral Maxillofac Implants* 2001;16:225–245.
21. Ventafridda V. Quality of life in oncology. In: Pollock RE (ed). *Manual of Clinical Oncology*. New York: Wiley-Liss, 1999:791–803.
22. Hyland ME, Sodergren SC. Development of a new type of global quality of life scale and comparison of performance and preference for 12 global scales. *Qual Life Res* 1996;5: 469–480.
23. Sriwatanakul K, Kelvie W, Lasagna L, Calimlim JF, Weis OF, Mehta G. Studies with different types of visual analog scales for measurement of pain. *Clin Pharmacol Ther* 1983; 34:234–239.
24. Schliephake H, Schmelzeisen R, Schonweiler R, Schneller T, Altenbernd C. Speech, deglutition and life quality after intraoral tumour resection. *Int J Oral Maxillofac Surg* 1998; 27:99–105.
25. Vaughan ED. An analysis of morbidity following major head and neck surgery with particular reference to mouth function. *J Maxillofac Surg* 1982;10:129–134.
26. List M, Ritter-Sterr C, Lansky S. A performance status scale for head and neck cancer patients. *Cancer* 1990;66:564–569.
27. Finlay PM. Prosthetic rehabilitation and implantology after cancer ablation. In: Booth PW, Schendel SA, Hausamen J-E (eds). *Maxillofacial Surgery*, vol 1. London: Churchill-Livingstone, Harcourt Brace and Company, 1999:759–783.
28. Krouse JH, Krouse HJ, Fabian RL. Adaptation to surgery for head and neck cancer. *Laryngoscope* 1989;99:789–794.
29. Chaturvedi SK, Shenoy A, Prasad KM, Senthilnathan SM, Premalatha BS. Concerns, coping and quality of life in head and neck cancer patients. *Support Care Cancer* 1996;4:186–190.
30. Blomberg S, Lindquist L. Psychological reactions to edentulousness and treatment with jawbone-anchored bridges. *Acta Psychiatr Scand* 1983;68:251–262.
31. Franks AST. The concept of oral rehabilitation. *J Oral Rehabil* 1976;3:1–8.