

Evaluation of Oral Health-Related Quality of Life after Rehabilitation with Single Implant Retained Mandibular Complete Overdenture in Elderly Patients

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Many elderly patients with considerably resorbed mandibular alveolar bone have problems with the retention and stability of their mandibular complete dentures resulting in poor oral health-related quality of life. The study was carried out to evaluate oral health-related quality of life (OHRQoL) after rehabilitation with one-implant retained mandibular complete overdenture in elderly patients. Thirty elderly mandibular edentulous patients were recruited and baseline OHRQoL was assessed by OHI-14 questionnaires. Single one-body implant (Dentium, Korea) was surgically placed at the midline of mandible and one month after surgery, mandibular complete overdenture retained by rubber O-ring attachment on the implant was prescribed. Post-treatment OHRQoL was assessed again and patient satisfaction was also determined by patient evaluation questionnaire. All patients reported excellent satisfaction on the prescribed treatment. There was highly significant difference between baseline OHRQoL and after rehabilitation OHRQoL ($p < 0.001$). In conclusion, single implant retained mandibular complete overdenture treatment dramatically improves the oral health-related quality of life for elderly patients.

Keywords: Oral health, Quality of life, Implant-retained mandibular complete overdenture, Elderly

INTRODUCTION

Tooth loss due to dental caries, periodontal disease and trauma is one of the major oral health problems in Myanmar. Although tooth preservation has been increasingly practiced, many people with limited financial capability still cannot afford relatively expensive tooth preservation treatments and they most often prefer extraction of diseased teeth. Moreover, many patients seek dental treatment only when the particular tooth has been damaged beyond the preservative treatments. For these reasons, tooth extraction is one of the most common treatment options in Myanmar.

According to several studies, tooth loss can affect general health in several ways as indicated as follows:¹ (a) lower intake of fruits and vegetables, fiber, and carotene and

increased cholesterol and saturated fats, in addition to a higher prevalence of obesity, can increase the risk of cardiovascular diseases and gastrointestinal disorders² (b) increased rates of chronic inflammatory changes of the gastric mucosa, upper gastrointestinal and pancreatic cancer, and higher rates of peptic or duodenal ulcers³ (c) increased risk of noninsulin-dependent diabetes mellitus⁴ (d) increased risk of electrocardiographic abnormalities, hypertension, heart failure, ischemic heart disease, stroke, and aortic valve sclerosis⁵ (e) decreased daily function, physical activity, and physical domains of health-related quality

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of life⁶ (f) increased risk of chronic kidney disease⁷ (g) association between edentulism and sleep-disordered breathing, including obstructive sleep apnea⁸

Conventional treatment for edentulous patient is fabrication of complete denture to restore oral function, comfort, appearance and health of the edentulous patient.⁹ However, many complete denture patients have difficulty in performing oral functions.¹⁰ Complete denture retention and stability can influence the patient's ability to function and are intimately and directly related to patient's confidence and comfort.¹¹ With continuing resorption of residual ridge, the retention and stability of dentures become reduced and pain and difficulty with oral functioning may even increase to an extent that proper nutritional intake and patients' ability to communicate with ease and confidence are jeopardized. In addition, less attractive facial appearance, difficulty with speech and avoidance of social contact may result in psychosocial problems. In addition to poor oral functions with unstable dentures, movement of the denture base on their basal seat can cause tissue damage and morphologic changes leading to even more reduction of the residual ridge.

With development of osseointegrated dental implants, prosthodontic rehabilitation of partially and totally edentulous patients has greatly evolutionized. The retention and stability of dental prostheses can be dramatically increased with dental implants and subsequently oral functions of the edentulous patients can be greatly improved. There are two main prosthetic options for completely edentulous patients; fixed detachable prostheses and removable overdenture prostheses. The implant retained overdenture is an attractive treatment option because of its relative simplicity, minimal invasiveness, and economy.

In order to improve retention and stability, two or more implant-retained mandibular overdentures have been recommended as standard of care for mandibular edentulous patients.¹² However, economic constraints

especially among the emerging elderly population in developing countries like Myanmar make this treatment strategy financially challenging.

Although two implants have been considered minimum for mandibular-retained overdenture treatment, single implant has shown to successfully retain mandibular denture at least over a medium-term period with low radiographic annual bone loss around implants and healthy peri-implant soft tissues.^{13, 14} This simplified single-implant* retained overdenture procedure involving very minor surgery remarkably can improve prosthesis stability and function as well as general oral comfort. In addition, larger bone ridges and thicker cortical bone can be found usually in the midline area of the mandible and lesser bone resorption could be related to more favorable stress forces developed on the single implant by the overdenture, specifically the horizontal forces.¹³ Walton *et al* compared treatment outcomes by one or two-implants retained mandibular overdenture and reported that using one implant to retain and stabilize the mandibular denture is as satisfactory as using two with the advantages of lower component costs and treatment times.¹⁵

Taken together, these studies suggest that a mandibular overdenture retained by a single midline implant may be an alternative to the customary two-implant overdenture for maladaptive denture patients. In a previous study, using a single implant in the mandibular midline area with ball attachment to support overdenture, favourable clinical outcomes were observed. It was demonstrated that the single implant-supported overdenture increased retention and stability as compared with the conventional complete overdenture; furthermore, the single implant presented other advantages such as lower component costs and shorter treatment time.¹⁶ Although single-implant retained mandibular overdenture is a promising alternative for edentulous patients, the limited research dedicated to this treatment concept has restricted its acceptance and implementation in wider population basis.

Moreover, the research is lacking on its applicability in elderly patients.

The OHRQoL is a broader appreciation of the impact of oral health. It should provide the basis for any oral health programme development. In the World Oral Health Report (2003), WHO listed the impact of oral health on the quality of life as an important element of the Global Oral Health Programme. Moreover, oral health care providers are urged to integrate the OHRQoL concept into their daily practice to improve the outcome of their services.¹⁰ The general objective of this research project was to evaluate oral health related quality of life (OHRQoL) after rehabilitation with one-implant retained mandibular complete overdenture in elderly patients.

MATERIALS AND METHODS

A clinical study with before-and-after study design was conducted. Thirty mandibular edentulous elderly patients (>60 years old) were recruited from the patients visiting the University of Dental Medicine, Mandalay and from those referred by private dentists who were informed about the subject recruitment. After thorough explanation and informed consent process, OHRQoL of all participants was assessed at baseline before rehabilitation treatment by using Oral Health Impact Profile (OHIP) questionnaire.¹¹

Conventional mandibular complete dentures were prescribed according to standard prosthodontic protocols performed at the Department of Prosthodontics, University of Dental Medicine, Mandalay. Investigations including cephalometric radiograph, blood tests for excluding diabetes mellitus, bleeding and clotting disorders were done. Only the subjects who were considered medically fit for minor surgery were included in the study. Two weeks after denture delivery, a single implant (one-body implant, Dentium, Korea) was placed surgically at midline of the mandible (Fig. 1) and 4 weeks after implant placement, the existing denture was modified to implant-retained mandibular complete overdenture by attaching the rubber

O-ring housing into the denture (Fig. 2). OHRQoL of all patients were assessed 2 weeks after attachment delivery. Paired t test was employed to compare OHRQoL at baseline and after prosthodontic rehabilitation.

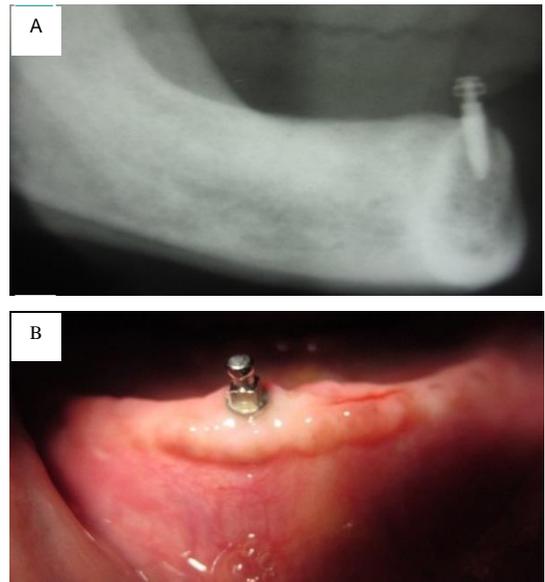


Fig. 1. (A) Lateral cephalometric radiological view and (B) clinical intraoral view of single midline onebody ball type implant placed in the subject



Fig. 2. Mandibular complete overdenture with O-ring housing attachment for denture retention

The OHIP-14 was designed to measure the impact of treatment on the subject's oral health. There were 14 questions on the OHIP-14. The 14 questions cover seven domains: functional limitation, physical pain, psychological discomfort, physical disability, psychological disability, social disability, and handicap. In response to each question, the study participants circled a scaled score

of 0 to 5 indicating frequency of impact on oral health. A “0” score indicated “never” and a “5” indicated “all the time”. “Seldom”, “sometimes”, “fairly often”, and “very often” corresponded to scores of 1, 2, 3, 4, respectively. The OHIP-14 composite score was calculated by summing the score for each of the 14 questions. Low scores on the OHIP-14 represented low impact or a higher quality of life. A composite score equal to 0 would represent the lowest (best) possible score for the OHIP-14, indicating no impact on OHRQoL. A composite score of 70 would represent the highest (worst) possible score for the OHIP-14, indicating significant impact on all seven domain of the OHRQoL.

The answers for each question of the OHIP-14 survey were summed to create a composite score. At the last research visit, Oral Health Impact Profile (OHIP-14) questionnaire, and a Prosthesis Evaluation Questionnaire (PEQ) was assessed. The PEQ was designed to measure the subject’s satisfaction with the denture. There were seven questions on the PEQ. The questions measured the subject’s satisfaction in the following seven areas: appearance, comfort, ability to chew, ability to speak, taste of foods, ease of inserting and removing the prosthesis. Each question was scored on a visual analog scale of 0 to 10, with 0 indicating “completely dissatisfied” and 10 indicating “completely satisfied”. High score on PEQ represented more satisfaction with the prosthesis. A composite score of “0” signified the lowest (worst) possible score on the PEQ, indicating complete dissatisfaction. A composite score of “70” signified the highest (best) possible score on the PEQ, indicating complete satisfaction.

Ethical consideration

The study received human subjects approval from Research and Ethical Committee, University of Dental Medicine, Mandalay with ERC approval date: August 31, 2018 and ERC approval number: Ethical/UDMM/2017/01. Participants provided written informed consent to participate.

RESULTS

Total 30 elderly edentulous patients (15 male and 15 female) participated in the study. Mean age of the participants was 65.8 years (minimum 60 and maximum 70) and all participants attended the necessary clinical visits regularly until the endpoint of study. In this study, there was no implant loss during study period. Clinically, all single implants located at the symphysis of anterior mandibles showed no signs and symptoms of mucositis, peri-implantitis, mobility, pain and discomfort.

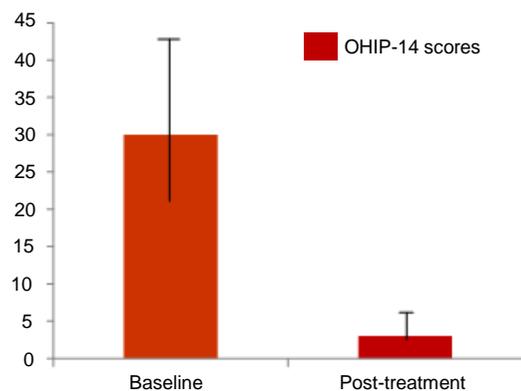


Fig. 3. Comparison of total Oral Health Impact Profile (OHIP-14) scores at baseline and after rehabilitation with overdenture

Participants were asked to answer the OHIP-14 questionnaires before and after implant overdenture treatment. Scores of each domain in the questionnaires were sorted and calculated as well as total scores. Mean OHIP-14 scores at baseline and after rehabilitation with implant overdenture were 30.1 ± 12.0 and 2.1 ± 2.5 (mean \pm SD), respectively (Figure 3).

There was highly significant difference between baseline OHIP-14 and after rehabilitation OHIP-14 ($p < 0.0001$). Since OHIP scores are inversely related to oral health-related quality of life (OHRQoL), this finding supports that implant overdenture effectively improve the oral health-related quality of life of the participants.

Table 1. Comparison of OHIP-14 scores (individual domain) at baseline and after rehabilitation with implant overdenture paired t test,

	OHIP-14 scores		
	Baseline	Post-treatment	p Value
Domain 1	4.2	0.3	<0.0001
Domain 2	4.7	0.6	<0.0001
Domain 3	3.8	0.2	<0.0001
Domain 4	4.9	0.4	<0.0001
Domain 5	4.8	0.3	<0.0001
Domain 6	3.6	0.1	<0.0001
Domain 7	4.0	0.1	<0.0001

OHIP= Oral Health Impact Profile

Baseline and post-treatment OHIP-14 scores for each domain are shown in Table 1. There were highly significant improvements in all 7 domains in OHIP-14 scores. It means that functional limitation, physical pain, psychological discomfort, physical disability, psychological disability, social disability, and handicap all were improved by implant overdenture.

Regarding patient satisfaction on the prosthesis, participants were asked to answer the questionnaire after the implant overdentures were fitted. Almost all patients had no difficulty in insertion and removal of the denture with implant ball attachment except the oldest patient who found difficulty in removing the denture. O-ring attachment was slightly released for him so that the denture could be easily removed. All participants verbally reported excellent comfort, increased ability to chew and ability to speak. Some participants reported that they could feel the taste of foods obviously better than before. All patients reported excellent satisfaction on the prescribed treatment. The mean patient satisfaction score by PEQ questionnaire was 63.5 ± 7.04 out of 70 which can be translated into mean satisfaction of 91%.

DISCUSSION

This is the first study done in edentulous elderly subjects in Myanmar evaluating the impact of edentulism and effect of single-

implant retained mandibular complete overdenture treatment on oral health-related quality of life (OHRQoL) of the elderly patients. Referring to the national population census 2014 data, the population of >60 years old citizen is gradually increasing together with other age groups.¹⁹ It is suggested to emphasize the importance of the dental care of geriatric patients since the geriatric population has expanded much more than that of 30-40 years ago.²⁰ Oral diseases are cumulative in nature and as people are getting older, they experience more and more attack of dental caries, periodontal disease and resultant tooth loss. Maxillary and mandibular complete dentures are the final treatment for those who lost all natural teeth.

Retention of a maxillary denture seldom presents the dentist or the patient with serious problems because the location of the seal area is fairly constant and it does not move during ordinary function of the mouth.²¹ Its retention is chiefly affected by three factors of the denture design: (1) the closeness of adaptation to the oral mucosa, (2) the extent of the denture base, and (3) the peripheral seal.²² Saung also stated that retention maxillary denture mainly depends on atmospheric pressure and affect by the speed of displacement, the peripheral seal, and the viscosity of saliva.²³

On the other hand, although retention of the mandibular denture depends upon a seal in the same manner as a maxillary denture, the seal area is not as readily located, and it has considerable movement during ordinary functions of the mouth.²⁴ Many patients remained dissatisfied and still had problems related with their oral functions because of poor retention and stability of the mandibular dentures^{25, 26} and greater rate of alveolar bone resorption in the mandible than that of the maxilla^{27, 28} further intensifies the problem.

In this study, participants with old mandibular complete denture reported very low OHRQoL reflecting the poor performance of conventional mandibular complete dentures. After single implant was placed and attach-

ment was used as an aid for retention mechanism, the OHRQoL was greatly increased. All participants reported they were very satisfied with eating, speaking, and self-confidence with denture after attachment connection. They reported that almost every food can be eaten and they taste better than before. It is speculated that the tongue which was busy all the time to stabilize the conventional denture, after the implant and attachment was done, became free and had time to perform efficiently its taste function.

Since our previous clinical study has already revealed significant improvement of retention and stability of mandibular complete denture with the application of single midline implant in the mandible, in the present study, we further examined the secondary outcomes such as OHRQoL and patient satisfaction. Limitations of the present study design were lack of control group and only single short-term observation after intervention. Although before-and-after design is most useful in demonstrating the immediate impacts of short-term programs, it is less useful for evaluating longer term intervention.

Nevertheless, the reported treatment strategy has many advantages. Existing complete dentures can be converted into implant-retained overdentures for many patients when moderate to extreme alveolar ridge resorption is present. The implant overdenture is supported by both implant and mucosa and therefore less damaging loads are directed on implant. When the attachment components are appropriately connected, the complete denture is held in position on the mucosa and both mucosa and implants provide support, retention and stability.

Moreover, it can be easily removed for hygiene. Additional advantages of single-implant retained mandibular overdentures are simpler surgical technique with minimum invasiveness, faster recovery of oral function and less total cost. The relatively simple treatment protocol and reduced cost mean

that a greater number of edentulous patients could benefit from this treatment strategy.

In conclusion, single-implant retained mandibular overdenture treatment would be regarded as a cost-effective promising treatment modality and beneficial in formulating a practical and effective delivery of prosthodontic rehabilitation for mandibular edentulous elderly population.

Competing interests

The authors declare that they have no competing interests.

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REFERENCES

1. Emami E, Freitas de Souza R, Kabawat M & Feine JS. The impact of edentulism on oral and general health. *International Journal of Dentistry* 2013; 2013: 498305. [doi.org/10.1155/2013/498305.]
2. Österberg T, Dey DK, Sundh V, Carlsson GE, Jansson, JO & Mellström D. Edentulism associated with obesity: A study of four national surveys of 16 416 Swedes aged 55-84 years. *Acta Odontologica Scandinavica* 2010; 68(6): 360-367. [doi: 10.3109/00016357.2010.514721.]
3. Abnet CC, Qiao YL, Dawsey SM, Dong ZW, Taylor PR & Mark SD. Tooth loss is associated with increased risk of total death and death from upper gastrointestinal cancer, heart disease, and stroke in a Chinese population-based cohort. *International Journal of Epidemiology* 2005; 34(2): 467-474.
4. Cleary TJ & Hutton JE. An assessment of the association between functional edentulism, obesity, and NIDDM. *Diabetes Care* 1995; 18(7): 1007-1009.
5. Völzke H, Schwahn C, Hummel A, *et al.* Tooth loss is independently associated with the risk of acquired aortic valve sclerosis. *American Heart Journal* 2005; 150(6): 1198-1203.
6. Mollaoglu MN & Alpar R. The effect of dental profile on daily functions of the

- elderly. *Clinical Oral Investigations* 2005; 9(3): 137-140. [doi:10.1007/s00784-005-0307-6]
7. Fisher MA, Taylor GW, Shelton BJ, *et al.* Periodontal disease and other nontraditional risk factors for CKD. *American Journal of Kidney Diseases* 2008; 51(1): 45-52.
 8. Bucca C, Cicolin A, Brussino L, *et al.* Tooth loss and obstructive sleep apnoea. *Respiratory Research* 2006; 7(1): 8 [doi:10.1186/1465-9921-7-8.]
 9. Zarb GA. Biomechanics of the Edentulous State. In: *Boucher's Prosthodontic Treatment for Edentulous Patients*. 11th ed, Mosby Co., St. Louis, 2003; p.8-29.
 10. Gosavi SS, Ghanchi M, Malik SA & Sanyal P. A survey of complete denture patients experiencing difficulties with their prosthesis. *Journal of Contemporary Dental Practice* 2013; 14(3): 524-527.
 11. Burns DR, Unger JW, Elswick RK & Giglio JA. Prospective clinical evaluation of mandibular implant overdentures: Part II-Patient satisfaction and preference. *Journal of Prosthetic Dentistry* 1994; 73 (4): 364-369.
 12. Zarb GA & Schmitt A. The longitudinal clinical effectiveness of osseointegrated dental implants: The Toronto study. Part I: Surgical results. *Journal of Prosthetic Dentistry* 1990; 63(4): 451-457.
 13. Cordioli G, Majzoub Z & Castagna S. Mandibular overdentures anchored to single implants: A five-year prospective study. *Journal of Prosthetic Dentistry* 1997; 78(2): 159-165.
 14. Krennmair G & Ulm C. The symphyseal single-tooth implant for anchorage of a mandibular complete denture in geriatric patients: A clinical report. *International Journal of Oral & Maxillofacial Implants* 2001; 16(1): 98-104.
 15. Walton JN, Glick N & Mac Entee MI. A randomized clinical trial comparing patient satisfaction and prosthetic outcomes with mandibular overdentures retained by one or two implants. *International Journal of Prosthodontics* 2009; 22(4): 331-339.
 16. Naing K, Nyan M, Ko K & Swe T. Clinical efficacy of single one piece implant retained mandibular overdentures. *Myanmar Dental Journal* 2018; 25(1): 45-58.
 17. World Health Organization. *The World Oral Health Report 2003: Continuous Improvement of Oral Health in the 21st Century - The Approach of the WHO Global Oral Health Programme*. Geneva, WHO, 2003.
 18. Slade GD & Spencer AJ. Development and evaluation of the oral health impact profile. *Community Dental Health* 1994; 11(1): 3-11.
 19. Department of Population. *The 2014 Myanmar Population and Housing Census, Highlights of the Main Results, Census Report Volume 2*. A. Naypyitaw, Ministry of Immigration and Population, 2015.
 20. Oo NSY, Nyan M, Htwe K, Hlaing S & Swe T. A study on association between age, gender and type of removable prosthodontic treatment needs in University of Dental Medicine, Yangon, Myanmar. *Myanmar Dental Journal* 2016; 23(1): 66-69.
 21. Wright CR. Evaluation of the factors necessary to develop stability in mandibular dentures. *The Journal of Prosthetic Dentistry* 2004; 92(6): 509-518.
 22. Watt DM. & MacGregor AR. *Designing Complete Dentures*. 2nd ed, Wright, IOP Publishing Limited, Bristol, 1986.
 23. Saung H. On complete denture retention. *Australian Dental Journal* 1983; 28(5): 277-280.
 24. Walsh JF & Walsh T. Muscle-formed complete mandibular dentures. *Journal of Prosthetic Dentistry* 1976; 35(3): 254-258.
 25. Van Waas MAJ. The influence of clinical variables on patients' satisfaction with complete dentures. *Journal of Prosthetic Dentistry* 1990; 63(3): 307-310.
 26. Beresin VE & Schiesser FJ. The neutral zone in complete dentures. *Journal of Prosthetic Dentistry* 1976; 36(4): 356-365.
 27. Tallgren A. The continuing reduction of the residual alveolar ridges in complete denture wearers: A mixed-longitudinal study covering 25 years. *Journal of Prosthetic Dentistry* 1972; 27(2): 120-132.
 28. Atwood DA & Coy WA. Clinical, cephalometric, and densitometric study of reduction of residual ridges. *Journal of Prosthetic Dentistry* 1971; 26(3): 280-295.