

Single implant in the mandibular molar region of edentulous patient

Jun-Jiang Zhai, MD, Cai Wen, MD, Ming-Hua Teng, MD, Xing Liang, MD.

ABSTRACT

يعد زراعة مثبت الجهاز السني الكامل أداة علاج فعالة للمرضى "الدرر" الذين ليس لديهم أسنان خاصة لمن يعانون من ضمور العظم النسخي. كما أن عمل زراعة واحدة مناسبة للاحتفاظ بالجهاز السني الكامل في الفك السفلي الخالي من الأسنان. ولكن في بعض المرضى لا توجد كمية طول أو عرض عظام كافية في منطقة ثقب الفك لإدخال الزراعة. في هذا التقرير نستعرض حالة غرس زراعة واحدة في منطقة ضرس الفك السفلي والذي يحافظ على الجراحة ترقيعية ويطور جودة وصحة الفم والأسنان ووظيفة المضغ. كما استخدم الرباط وذلك للاحتفاظ بالجهاز السني الكامل. أن النتائج الإكلينيكية لعام واحد تعد واعدة. ولكن نحن بحاجة إلى نتائج إكلينيكية طويلة المدى وتجارب عشوائية مخبرية قبل استعمال هذه الطريقة بشكل واسع في التطبيقات الإكلينيكية.

Implant-retained overdentures are a valid treatment option for edentulous patients, especially for patients with severe alveolar ridge atrophy. A central single implant is considered adequate to retain an overdenture in the edentulous mandible. However, for some patients, there is no sufficient bone height, or width in the interforaminal region of the mandible for insertion of the implant. This case report illustrates that the insertion of a single implant in the mandibular molar region might stabilize the prosthesis, and might improve the oral health-related quality of life and chewing function. A Locator attachment was used in this case to retain the overdenture. The one-year clinical results are promising. However, long-term clinical results and randomized clinical trials are needed before this method can be widely used in clinical application.

Saudi Med J 2013; Vol. 34 (9): 963-967

From the State Key Laboratory of Oral Diseases, West China Hospital of Stomatology, Sichuan University, Chengdu, Sichuan, China.

Received 5th June 2013. Accepted 29th July 2013.

Address correspondence and reprint request to: Dr. Xing Liang, State Key Laboratory of Oral Diseases, West China Hospital of Stomatology, Sichuan University, No.14, 3rd Section Renmin South Road, Chengdu, Sichuan, China. Tel. +86 (28) 85502141. Fax. +86 (28) 85502407. E-mail: xingliangdent@vip.163.com; zcole2012@163.com

Implant overdentures were widely used in oral clinics. Researchers suggested that the 2-implant overdenture should be the first choice of treatment for edentulous mandible.¹ However for many patients, 2 implants can be cost-prohibitive. Recent study showed that a single implant placed in the midsymphyseal region of the mandible can be successful for mandibular overdenture support.² Compared to 2 implants, the single implant had significantly lower costs, reduced surgery time, less associated morbidity, and less postsurgical maintenance.³⁻⁵ The implant of the above mentioned single implant-retained overdenture is mainly inserted in the interforaminal region of the mandible. However, for those patients who through the operation of trauma or tumor in mandible, there is no sufficient bone height or width in the interforaminal region of the mandible. For those patients, the implant-retained overdenture with a single implant in the mandibular molar region is a viable treatment option. So far, clinical results of this method were rarely reported. Therefore, we report this case to show the significant clinical effect of implant-retained overdenture with a single implant in the mandibular molar region.

Case Report. A 40-year-old man visited the Department of Prosthodontics, West China College of Stomatology, Sichuan University, Chengdu, Sichuan, China for help. The patient's chief complaint was that his prosthesis easily fell off when eating, and that he wanted to solve the problem with the lowest cost. Two years ago, he was treated with a bilateral mandibular body resection, and a free fibula graft with microvascular anastomosis due to mandibular ameloblastoma. He did not receive any radiation therapy. He had worn

Disclosure. Authors have no conflict of interests, and the work was not supported or funded by any drug company.

a conventional mandibular complete denture for one year, and found it very difficult to eat with it. From the clinical examination, we found that the patient had normal range of mandibular motion with no deviation. The temporomandibular joint, facial, and masticatory muscles were all asymptomatic. The mandibular alveolar ridge was severely atrophied and the maxillary teeth were all existent (Figure 1). The retention of his old prosthesis was not ideal. His old prosthesis easily became dislodged when chewing, or opening a big mouth (Figure 2). The panoramic radiograph and cone beam computed tomography (CBCT) showed that the mandibular body had disappeared, and in its place, there was a bone fixed by a metal plate. Only a small amount of alveolar bone remained on the left side of his mandible (Figure 3 and Figure 4).

Treatment procedures. According to the clinical examination, the CBCT information and the chief complaint of the patient, treatment protocol was fabricated, which included the site and direction of implantation, the diameter, and length of the implant. First, an International Team for Implantology (ITI) (Straumann AG, Waldenburg, Switzerland) implant of 4.1 mm in diameter and 10 mm in length was placed

in the left mandibular molar region of the patient. Implant placement was undertaken by an experienced oral surgeon using a standard surgical procedure established for the ITI implant system. Two months after the implantation, a new conventional mandibular complete denture was fabricated using a standardized procedure by an experienced prosthodontist. The prosthesis was made in central occlusion with balanced articulation and anatomically shaped acrylic teeth. One premolar and 2 molars were used in each quadrant of the prosthesis. Prosthesis base was relieved in the implant area by grinding to avoid pressure and overload at the implant site during the healing time. Then, the patient was allowed to wear his new prosthesis without attachment for 4 months. Six months after implantation, the second-stage surgery was performed. A Locator attachment system was utilized following the Locator user guide. Finally, the patient was carefully instructed in oral hygiene and in the handling of the implant-retained overdenture. After restoration, the patient was followed up for 12 months.

Objective masticatory function. At 2 months after the conventional mandibular overdenture delivery, and at 2 months after the final restoration, the masticatory

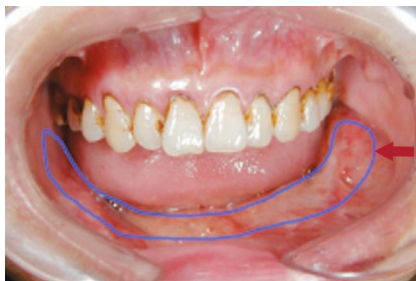


Figure 1 - Poor alveolar ridge height as seen from the anterior view before treatment (area outlined in blue, as shown by the red arrow).

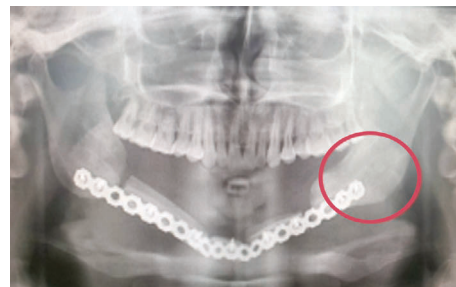


Figure 3 - Panoramic radiograph showing only a small amount of bone in the alveolar ridge remaining in the left mandibular molar region (red circle).



Figure 2 - The patient's old prosthesis was easily dislodged when opening the mouth wide.

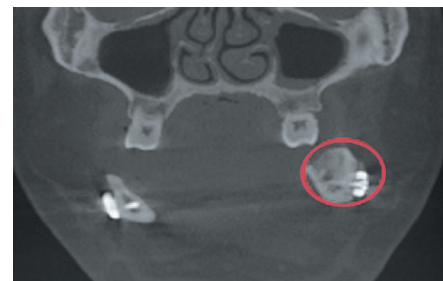


Figure 4 - Cone beam CT information showing that a small amount of bone was left in his left mandibular molar region (red circle).

efficiency (ME) was evaluated using the gravimetric method. The patient was instructed to chew test food (4 g of peanuts) normally for 20 seconds. The peanuts used in this test were dried in an oven at 105°C for 3 hours and exhibited a uniform size. The chewed peanuts were expectorated in a cup, and the mouth was thoroughly rinsed twice with water (15 ml). The rinsings were added to the cup to recover all the test food. This test was repeated 3 times. The entire content of the cup was poured onto a 20-mesh US standard sieve. Fine particles were washed through the 20-mesh sieve with a jet of water from a wash bottle onto the sieve. The content of the 20-mesh sieve was dried in an oven at 105°C for 3 hours and weighed in the nearest electronic balance to establish the weight (m). The masticatory efficiency of the patient was ME ($ME = 4 - m/4 \times 100\%$)

Oral health-related quality of life (OHRQoL).

The reliable and validated German version of the Oral Health Impact Profile (OHIP-49)⁶ was used to evaluate the OHRQoL at 2 months after the conventional mandibular overdenture delivery, and at 2 months after the final restoration. The OHIP is a standardized assessment instrument for measuring the OHRQoL. It was tested previously for internal reliability, test/retest reliability, and validity. Every item of the OHIP was scaled using a 5-point scale: never - 0; rarely - 1; occasionally - 2; often - 3; and very often - 4. The sum of scores was calculated by adding the item scores and ranged between 0 and 196.

Treatment outcomes. At one-year follow-up, the single implant-retained overdenture worked well. The soft tissue surrounding the ITI abutment was healthy (Figure 5). The CBCT examination was taken one year after the final restoration. The result showed that marginal bone resorption of the implant was not obvious (Figure 6). According to the standard of implantation success, the implant was successful.⁷ The patient was very compliant and consistently expresses to us how this treatment has “changed his life” (Figure 7). At his return visit 10 months after the final restoration, the patient complained about decreased retention of his prosthesis. After examination, we found that this decrease in retention was due to excessive wear of the male part of the Locator attachment system. After replacing an appropriate male part of the Locator attachment system, the retention was regained. The denture base fracture occurred at the site of Locator abutment at the return visit 12 months after the final restoration. We repaired the denture with autopolymerizing acrylic resin. After that, it worked well (Figure 8).



Figure 5 - The healthy soft tissue surrounding the ITI (International Team for Implantology) abutment (red circle).

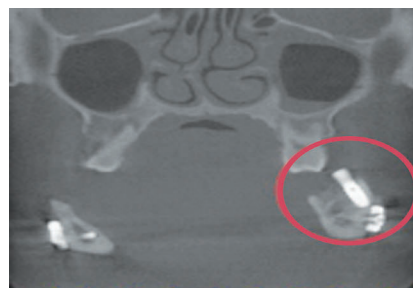


Figure 6 - The cone beam CT information showed that no obvious bone resorption was found one year after the final restoration (red circle).



Figure 7 - The prosthesis did not easily fall off even when the patient opened his mouth wide.



Figure 8 - A clinical view of the implant-retained prosthesis after being repaired with autopolymerizing acrylic resin.

The masticatory efficiency was 0 at 2 months after the conventional mandibular overdenture delivery. At 2 months after the final restoration, the results were 40.57%. The patient's chewing function had been significantly improved.

The OHIP total score of the patient was 78 at 2 months after the conventional mandibular overdenture delivery and improved after using the single implant-retained overdenture to a value of 37. Thus, the OHRQoL of the patients increased significantly.

Discussion. This case report illustrates the treatment method of the implant-retained overdenture with a single implant in the mandibular molar region. This method is a viable treatment option only for those patients whose bone height, or width in the interforaminal region of the mandible is not sufficient. The latest technology Computer-Aided Design and Computer-Aided Manufacturing (CAD-CAM) may be another choice for these patients.⁸ However, the long-term result of the CAD-CAM technology is unknown and had significantly higher costs. So the treatment method illustrated in this case report may be more suitable for those patients. There are a bundle of nerves and vessels in the mandibular molar region, which may increase the risk of damage to neurovascular supply, although there was no clinical complication observed in this case. In order to avoid disrupting the nerves and vessels, a CBCT examination is required before the implantation, and the implant placement should be undertaken by an experienced oral surgeon.

Different attachment systems are available to attach overdentures to implants. Ball attachments and Locator attachments seem to be favorable because of their good retention and ease of use. Compared with the ball attachments, the Locator attachment showed a higher rate of prosthodontics maintenance.⁹ Therefore, the Locator attachment system was used in this case. The patient was followed-up for one year. The retention loss of the prosthesis occurred 10 months after the final restoration. The denture base fracture occurred 12 months after the final restoration. The fracture occurred at the site of Locator abutment. The loss retention of the Locator attachment system is mainly due to excessive wear of the Locator male part. After replacing it, the retention could be regained. In addition, the denture fracture at the site of Locator abutment might be related to the relatively thin denture base because of the small space between the mandibular molar region and maxillary teeth. The use of a CoCrMo alloy framework seems to be a good option for thin dentures in this area, but it will increase treatment costs.

According to the result the OHIP questionnaire and masticatory function test, the OHRQoL and the masticatory efficiency of the patient had been greatly improved. This result is in agreement with the finding

of other researchers, though the single implant was placed in the midsymphiseal region of the mandible in their studies.^{5,10} This indicates that the insertion of a single implant in the mandibular molar region can obtain similar clinical results as insertion of a single implant in the mid-symphiseal region of the mandible. In a similar research, the single implant was placed in the midsymphiseal region of the mandible, and the patient had a mandibular implant-retained overdenture opposing a complete maxillary denture.^{5,10} However, in this case, the single implant was placed in the mandibular molar region. This might cause the denture sinking during chewing function due to the lack of hard tissue support in the right side. At one-year follow-up, no obvious denture sinking occurred. This may be due to the proper bilateral balanced occlusion in centric relation, which is especially important for this patient. The patient has a whole dentition in the maxillary, so the lower denture has to oppose to heavy masticatory force. In order to avoid treatment failure due to the heavy chewing force, this overdenture should be designed to be supported both by the implant and the soft tissue. And we also should remind the patient not to eat tough foods after the final restoration. It is usually impossible for these patients to re-implant because there is no sufficient bone structure. So we should carefully instruct the patients to promote good oral hygiene, and regularly check his oral hygiene to avoid peri-implantitis or implant failure.

In conclusion, within the limitations of this case, a mandibular single implant-retained overdenture with the implant placed in the mandibular molar region can improve OHRQoL and objective masticatory function of the patients who have no sufficient bone height, or width in the interforaminal region of the mandible. However, long-term clinical results and randomized clinical trials are needed before this method can be widely used in clinical application.

References

1. Feine JS, Carlsson GE, Awad MA, Chehade A, Duncan WJ, Gizani S, et al. The McGill consensus statement on overdentures. Mandibular two-implant overdentures as first choice standard of care for edentulous patients. Montreal, Quebec, May 24-25, 2002. *Int J Oral Maxillofac Implants* 2002; 17: 601-602.
2. Walton JN, Glick N, Macentee MI. A randomized clinical trial comparing patient satisfaction and prosthetic outcomes with mandibular overdentures retained by one or two implants. *Int J Prosthodont* 2009; 22: 331-339.
3. Krennmair G, Ulm C. The symphyseal single-tooth implant for anchorage of a mandibular complete denture in geriatric patients: a clinical report. *Int J Oral Maxillofac Implants* 2001; 16: 98-104.

4. Alsabeeha N, Payne AG, De Silva RK, Swain MV. Mandibular single-implant overdentures: a review with surgical and prosthodontic perspectives of a novel approach. *Clin Oral Implants Res* 2009; 20: 356-365.
5. Wolfart S, Braasch K, Brunzel S, Kern M. The central single implant in the edentulous mandible: improvement of function and quality of life. A report of 2 cases. *Quintessence Int* 2008; 39: 541-548.
6. John MT, Patrick DL, Slade GD. The German version of the Oral Health Impact Profile-translation and psychometric properties. *Eur J Oral Sci* 2002; 110: 425-433.
7. Albrektsson T, Zarb GA, Worthington P, Eriksson AR. The long-term efficacy of currently used dental implants: A review and proposed criteria of success. *Int J Oral Maxillofac Implants* 1986; 1: 11-25.
8. Sethi A, Kaus T, Sharma N, Sochor P. Managing the edentulous mandible using recent technological developments: a case study. *Prim Dent J* 2013; 2: 50-54.
9. Kleis WK, Kämmerer PW, Hartmann S, Al-Nawas B, Wagner W. A comparison of three different attachment systems for mandibular two-implant overdentures: one-year report. *Clin Implant Dent Relat Res* 2010; 12: 209-218.
10. Schneider GB, Synan WJ. Use of a single implant to retain a mandibular complete overdenture on the compromised atrophic alveolar ridge: a case report. *Spec Care Dentist* 2011; 31: 138-143.

Illustrations, Figures, Photographs

Four copies of all figures or photographs should be included with the submitted manuscript. Figures submitted electronically should be in JPEG or TIFF format with a 300 dpi minimum resolution and in grayscale or CMYK (not RGB). Printed submissions should be on high-contrast glossy paper, and must be unmounted and untrimmed, with a preferred size between 4 x 5 inches and 5 x 7 inches (10 x 13 cm and 13 x 18 cm). The figure number, name of first author and an arrow indicating "top" should be typed on a gummed label and affixed to the back of each illustration. If arrows are used these should appear in a different color to the background color. Titles and detailed explanations belong in the legends, which should be submitted on a separate sheet, and not on the illustrations themselves. Written informed consent for publication must accompany any photograph in which the subject can be identified. Written copyright permission, from the publishers, must accompany any illustration that has been previously published. Photographs will be accepted at the discretion of the Editorial Board.