Comparison of the Masticatory Functions of Complete Dentures and Implant-Retained Overdentures

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The aim of this study was to evaluate the changes in the masticatory functions of complete dentures before and after the insertion of a LOCATOR attachment. The mixing ability index with a two-colored paraffin wax cube was used to quantify masticatory performance. In addition, degree of satisfaction with the treatment was assessed using a visual analog scale. The mixing ability index for the implant-retained overdentures and the complete dentures were calculated (−0.03 ± 1.38 and −2.10 ± 1.57, respectively), as were the visual analog scales of the implant-retained overdentures and the complete dentures (8.9 ± 1.5 and 4.3 ± 1.7, respectively). The paired t test revealed significant improvements ($P < .001$). Int J Prosthodont 2015;28:345–347. doi: 10.11607/ijp.4070

Implant overdentures have advantageous effects such as improved stability and retention, but their effects on masticatory efficiency remain controversial.[1,2] In previous studies, the masticatory efficiency of overdentures has been investigated mainly by comparing individuals currently wearing complete dentures with individuals currently wearing newly fabricated overdentures.[2] Furthermore, in such studies, the evaluation factors associated with fitting, occlusion, and articulation were barely controlled.

In the present study, we aimed to evaluate the masticatory efficiency and self-assessed masticatory function of implant-retained dentures with respect to changes in masticatory performance when mandibular complete dentures were modified to implant-retained overdentures. The dentures of each subject were controlled to keep them close to their equivalent pre-modification. The mixing ability index (MAI)[3] and a visual analog scale (VAS) were used to quantify the masticatory function. The LOCATOR attachment (Zest Anchors) was used to convert complete dentures to implant-retained overdentures in all the subjects.

Materials and Methods

This study comprised eight participants (three men and five women, age range: 61 to 81 years, mean age: 71.6) who visited the Department of Prosthodontics of Pusan National University Dental Hospital. The inclusion criteria were (1) complete dentures in the mandible and maxilla, prepared at the Department of Prosthodontics; (2) dentures with maintained sound occlusion and fitness; (3) absence of temporomandibular joint disorders and uncontrollable systematic diseases; and (4) provision of the subject's written informed consent. This research was reviewed and approved by the Institutional Review Board of Pusan National University Dental Hospital (IRB no. PNUDH-2013-004).

The dentures were prepared using anatomical resin teeth (Endura, Shofu) with a 20-degree cusp inclination and a fully balanced occlusal scheme. The functional adequacies of the complete dentures and their corresponding implant-retained overdentures were evaluated by a prosthodontist. Two implants were placed in the mandibular right and left canine areas. Secondary surgery was performed 2 months later.

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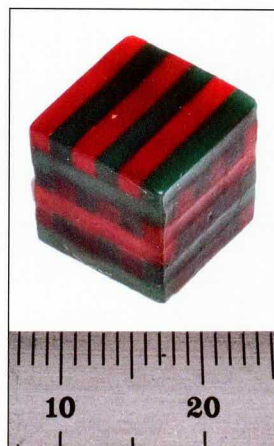
Fig 1 The two-colored paraffin wax cube used in the mixing ability test. The red and green 2 × 2 × 12-mm cuboids were woven to form a 12 × 12 × 12-mm cube.
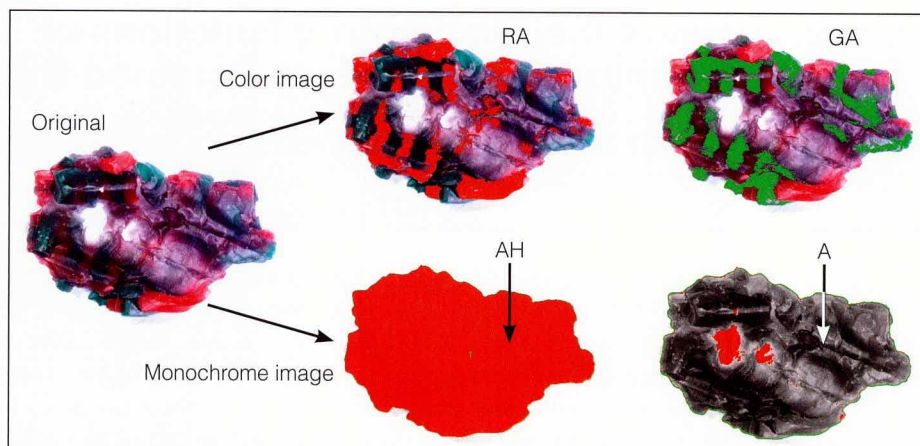

Fig 2 Image analysis of the chewed wax cube. RA = red area; GA = green area; AH = total projection area; and A = greater than 50-μm-thick projection area.
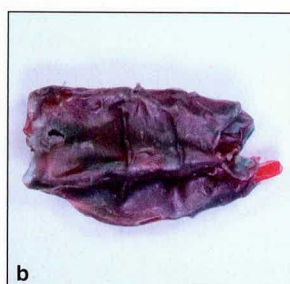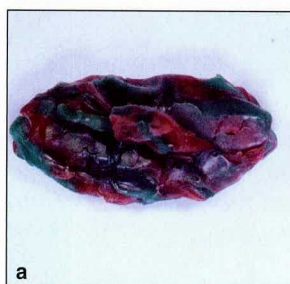

Fig 3 The wax cube specimens obtained by Subject 7. The more thoroughly mixed red and green colors indicate an increase in the MAI. **(a)** MAI while wearing the complete dentures at −0.82. **(b)** MAI while wearing the implant-supported overdentures at 1.87.

Table 1 Average Values of the Mixing Ability Index

Subject no.	Complete dentures	Implant-retained overdentures	t	P
1	−1.28	0.44		
2	−2.23	0.00		
3	−0.50	−1.34		
4	−2.93	−1.90		
5	−3.47	0.21	−5.29*	.000
6	−3.49	−1.53		
7	−1.50	1.05		
8	−1.41	0.65		
Mean ± SD	−2.10 ± 1.57	−0.03 ± 1.38		

*$P < .001$.

The masticatory efficiencies were measured using a mixing ability test and a wax cube, as previously stated.[4] The complete dentures-wearing participants were asked to indicate their preferred chewing side and then to masticate using 10 chewing cycles of a wax cube composed of red and green rectangular wax blocks arranged to form a single 12 × 12 × 12-mm block (Utility Wax, Daedong) (Fig 1). Two months after placement of the LOCATOR attachment, an identical wax-chewing experiment was conducted.

The MAIs were calculated using a method introduced in a recent study (Fig 2).[3] A VAS was used to survey the participants' subjective satisfaction with their complete dentures and implant-retained overdentures.

The paired t test was performed on the MAIs and VASs at a 95% confidence level. All statistical analyses were performed using SPSS Statistics 19 (IBM).

Results

Of the eight study subjects, seven showed an increase from their baseline MAIs after they wore the implant-retained overdentures. The paired t test results showed that the mean MAI for the implant-retained overdentures was −0.03 ± 1.38 (mean ± SD), which represented a significant improvement over the −2.10 ± 1.57 (mean ± SD) of the complete dentures ($P < .001$) (Fig 3) (Table 1).

Table 2 Degrees of Subject Satisfaction

Subject no.	Complete dentures	Implant-retained overdentures	Difference	t	P
1	−1.28	6.1	1.8		
2	−2.23	10	5.3		
3	−0.50	9.3	4.1		
4	−2.93	9.6	5.2		
5	−3.47	9.4	6.0	−6.916*	.0002
6	−3.49	10	6.5		
7	−1.50	7.0	2.4		
8	−1.41	10	2.9		
Mean ± SD	−2.10 ± 1.57	8.9 ± 1.5	4.3 ± 1.7		

*$P < .001$.

According to the VAS evaluation, implant-retained overdentures had a score of 8.9 ± 1.5 (mean ± SD), which represented a significant score improvement of 4.3 ± 1.7 (mean ± SD) versus the 2.10 ± 1.57 (mean ± SD) of the complete dentures ($P < .001$) (Table 2).

Discussion

In this study, we observed a significant improvement in masticatory performance with implant-retained overdentures. This study differs from previous ones in that the masticatory efficiencies were measured with complete dentures and implant-retained overdentures after ensuring similar denture conditions. In previous studies, conventional test foods with high brittleness and low viscosity, such as peanuts and carrots, were mainly used.[1,2] The wax cubes used in the present study had relatively high viscosity, which is known to be more appropriate for evaluations of masticatory efficiency in patients with compromised masticatory performance.[5]

Although implant-retained overdentures have higher overall patient satisfaction ratings than complete dentures, a standardized method of evaluation and a suitable questionnaire, such as the Oral Health Impact Profile, may be needed to accurately evaluate patient satisfaction.

Conclusions

This preliminary report suggests that edentulous individuals who want to improve the masticatory performance of their complete dentures may potentially benefit from the alternative treatment option of modifying their complete dentures to overdentures retained by two implants.

Acknowledgments

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