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Repercussion of Conventional Complete Mandibular Denture Versus Single Implant Over-Denture on Retention and Biting Force

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Abstract

AIM: Aim of this study was the evaluate the retention and biting force of conventional complete denture and after placement of a single implant in the mandible for an implant-retained over-denture.

MATERIALS AND METHODS: Eight completely edentulous patients were selected. A single implant was inserted at the symphysis of the mandible and left to osseointegrate. During the osseointegration period, a conventional complete denture was fabricated and inserted. Retention and biting force were measured at insertion and after 3 months of service. After osseointegration attachment was connected, space was formed in the fitting surface of the existing mandibular denture and retention silicon was placed. Retention and biting force were measured at insertion and after 3 months of follow-up. Data were collected and statistically analyzed.

RESULTS: The retention mean values for the complete denture was 2.420 ± 0.360, however, the retention mean values for the single implant over-denture was 6.395 ± 0.289. F = 3.80 with statically significant difference between the groups of $p < 0.01$. The biting force mean value for the complete denture was 52.62 ± 2.71, however, the biting force mean value for single implant over-denture was 71.45 ± 2.73. F = 1.790 with statically insignificance difference between the groups of $p > 0.01$.

CONCLUSION: Single implant overdenture improved the retention and the biting force when compared with the complete denture, this has improved the quality of life and happiness.

Introduction

Due to the many inherited problems of conventional complete dentures such as retention and support, implant-retained over-denture was proposed to solve these problems. Especially in the mandible where the denture bearing area is limited. The main problems reported with a mandibular complete denture can be significantly improved with the use of implants and retentive attachments [1], [2].

Mandibular overdentures supported by only a few intra-foraminal implants are regarded today as a geriatric treatment modality. Mandibular over-dentures may benefit older patients who, having had complete dentures for many years, lose their motor skills and no longer feel able to wear complete dentures. This problem is observed much more often for the edentulous mandible than the maxilla. Even with advanced atrophy, standard surgical implant procedures can be applied for mandibular over-dentures [3].

Implant retained over-denture improved the problems of retention of the denture dramatically, but on the expense of cost. The cost of the dentures increased as a result of the installation of implants, which might be a problem for many patients. This problem has driven dentists to search for the minimum number of implants required to provide good retention and doesn't increase the cost of the prosthesis. Implant retained with two implants improved retention, stability, and patient satisfaction, but the cost is relatively high for a large segment of the population [4].

This has driven toward a single implant placed at the symphysis of the mandible. Single implant improved retention, stability, and patient satisfaction when compared with the conventional complete denture. Also, its success was very comparable with the two implant over-denture besides being less invasive [5], [6].

It was investigated that retention is one of the most fundamental factors of the success of a prosthesis and a prime factor in the oral health-related quality of life. Retention is a key element in happiness and quality of life for edentulous patients [7].

Biting force is an indicator for the musculature condition, which has a direct influence over the chewing efficiency and patient's quality of life [8], [9], [10].

Materials and Methods

Ethical consideration

The protocol and consent were approved by Institutional review board/ethical committees with

respect to scientific content, compliance with applicable research, and human subjects regulations.

Eight patients were selected from the out-patient clinic of MSA University, Egypt. Patients fulfilled the following criteria.

Inclusion criteria

- Completely edentulous male patients aged between 50 and 60 years old
- Systemically controlled
- Adequate Inter-arch space ≥12 mm.

Exclusion criteria

Patients with debilitating disease, smoking and para-functional (clenching or bruxism, etc.) habits, and those who have received local radiotherapy within 1 year.

A single implant SKY implant from BREDENT was inserted in the symphysis region of the mandible. Fabrication of a conventional complete denture was initiated. After fabrication of the denture, it was inserted. Retention and biting force were measured immediately after insertion. Retention was measured using FORCE GAUGE from EXTECH; a pushing dislodging force at the labial notch of the denture was applied. The biting force was measured using the LOADSTAR sensor, the sensor was placed on the premolar–molar area. Patients applied maximum biting force on the sensor; measurements were taken for both sides of the denture. After 3 months, measurements were taken again with the same procedures for both the retention and biting force.

After osseointegration of the implant, secondary stage surgery was done and TISI attachment from BREDENT was screwed to the implant. Space was grinded in the fitting surface of the existing complete denture opposing to the attachment and retention silicon RETENTION SIL from BREDENT was added. The patient was allowed to occlude in centric until the complete setting of the silicon. Excess was trimmed using silicon bur Figure 1.

Measurements for retention and biting force was done at the time of attachment placement and after 3 months using the same procedure.

All data for the conventional complete denture and the single implant overdenture were collected statically analyzed and tabulated using One-way Anova.

Results

The retention mean values at insertion

The retention mean values for the complete denture was 1.78 ± 0.297, however the retention mean values for the single implant over-denture was 6.19 ± 0.173. F = 3.89 with statically significant difference between the groups of $p < 0.05$.

Figure 1: Implant at symphysis with TISI attachment connected

The biting force mean values at insertion

The biting force mean value for the complete denture was 50.53 ± 3.31, however, the biting force mean value for single implant over-denture was 70.60 ± 1.167. F = 18.98 with statically significant difference between the groups of $p < 0.01$.

The retention mean values after 3 months

The retention mean values for the complete denture was 2.42 ± 0.360, however, the retention mean values for the single implant over-denture was 6.39 ± 0.289. F = 3.80 with statically significant difference between the groups of $p < 0.01$.

The biting force mean values after 3 months

The biting force mean value for the complete denture was 52.62 ± 2.71, however, the biting force mean value for single implant over-denture was 71.45 ± 2.73. F = 1.790 with statically insignificance difference between the groups of $p > 0.01$ Table 1.

Effect of time on the retention of the complete denture and single implant over-denture

Retention mean values of the complete denture along the follow-up period showed an insignificant difference of $p > 0.01$.

Retention mean values of the single implant over-denture along the follow-up period showed a significant difference of $p < 0.01$.

Table 1: Mean values and standard deviation of the retention and biting force of complete denture and single implant over-denture at insertion and after 3 months

Follow up period	Retention/N of complete denture	Retention/N of single implant over-denture	Biting force/N of complete denture	Biting force/N of single implant over-denture
At insertion	1.79 ± 0.297	6.19 ± 0.173	50.53 ± 3.31	70.60 ± 1.167
After three months	2.42 ± 0.360	6.39 ± 0.289	52.62 ± 2.71	71.45 ± 2.73

Effect of time on the biting force the complete denture and single implant over-denture

Biting force mean values of the complete denture along the follow-up period showed a significant difference of $p < 0.01$.

Biting force mean values of the single implant over-denture along the follow-up period showed an insignificant difference of $p > 0.01$.

Discussion

Retention at insertion and after 3 months

The low values of retention at insertion in the complete denture can be directly attributed to the inherited problems of the lower arch. Small surface area of the mandible results in a limited denture bearing area, leading to lower retention and stability of the denture. There was a significant difference between the retention mean values between the complete denture and the single implant over-denture at insertion and after the follow-up period. This is due to the added means of retention in the form of the attachment. The attachment provided mechanical means of retention besides the physiologic retentive means already present. This result confirms with Cheng *et al*. [11] in which they measured patient satisfaction concerning the retention of the mandibular denture before and after connection of attachment. They found out that patient satisfaction concerning the retention increased significantly after the connection of the attachment.

Biting force at insertion

Regarding the biting force at insertion, there was a significant difference in the mean values between the complete denture and the single implant over-denture. The single implant over-denture recorded higher values than the complete denture this can be due to better stability of the denture and the slight fixation profound by the attachment. Complete denture is totally supported by mucosa, which is compressible and movable in nature. This results in movement and lack of stability of the conventional complete denture and thus less values of biting force. Maximum biting force is a direct result of stability and denture support [12], [13], [14]. Our result agrees with Wafaa *et al*., [15] which found that biting force was higher in implant-supported over-denture than in the conventional complete denture.

Biting force after 3 months

After follow-up period, there was an insignificant difference between the biting force in complete denture and single implant over-denture. This can be related to many factors; first of all the patients became more accustomed to their complete dentures, secondly, they have more control and confidence over their dentures [15], [16].

In the single implant over-denture, the psychological impact is already instilled after the connection of the attachment at insertion time, so the improvement of the biting force is already achieved. This is opposing to Wafaa *et al*., [15] in which they had significant difference between the groups through out their follow-up period.

Effect of time within the complete denture group

The increase of retention in the complete denture after 3 months was insignificant. The increase can be attributed to settling of the denture occurs, muscle control over the denture, saliva film, and atmospheric pressure becomes more prominent, but still not enough to attain the desired retention for patients. This result confirms with Ebrahim *et al*. [17] in which they got similar results regarding the conventional complete denture after 1 month of follow-up. However the biting force increased significantly as said before as the patients became more accustomed to their complete dentures, secondly, they have more control and confidence over their dentures [16].

Effect of time within the single implant over-denture group

The retention in single implant over-denture increased significantly after the follow up period, this can be due to better adaptation and concealment of the retention silicon on the TISI attachment. This result is against Niedermeier [18], who found no significant change during his follow-up period. For the biting force there was an insignificant difference during the follow-up period, this can explained as said before due to the psychological impact is already instilled after connection of the attachment at insertion time. The patient feels confident of his dentures immediately after the connection of the

attachment. Besides that, the patients had already adapted to the denture during the complete denture stage, so there was no adaptation phase.

Conclusion

Single implant over-denture proved to be an efficient alternative to complete denture by improving the retention and the biting force. Also, single implant showed that it be comparable in the effectiveness to two implant over-denture, besides to lower costs which is almost half of the two implant over-denture.

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