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ORIGINAL ARTICLE

The Comparison of Masticatory Efficiency between Conventional Complete Denture and Implant Retained Overdenture

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ABSTRACT

Objectives: The study aimed to compare the masticatory efficiency of conventional complete dentures (CCD) and mandibular implant retained overdentures (IRO).

Material and Methods: A quasi experimental study was conducted involving 20 completely edentulous patients divided into two equal groups: Group A received CCD and Group B received implant retained overdentures in the mandibles. Subjective evaluation was carried out which include color change scores on 1-5 likert scale for masticatory efficiency and VAS for chewing satisfaction. Data were analyzed using SPSS 23.0 version and Mann Whitney U test and Spearman's rank correlation was used to compare performance and examine relationships between variables and level of significance was $p<0.05$.

Results: Subjective color change and VAS rating were also markedly better in IRO group (4.5±0.53 and 8.4±0.70 respectively) than in CCD group (2.7±0.67 and 4.8±0.79; $p<0.001$). Spearman's correlation revealed a strong positive relationship between subjective color change score and VAS which were statistically significant (Spearman's $p=0.982$, $p<0.000001$).

Conclusion: The findings of this study concluded that implant retained overdentures significantly improve masticatory efficiency and patient satisfaction compared to conventional complete dentures.

Keywords: Edentulism, chewing gum, implant-retained overdenture, masticatory efficiency, conventional denture.

INTRODUCTION

Tooth loss remains a significant global health concern, particularly among the aging population.[1] Edentulism or the complete loss of natural teeth is adebiliating condition that compromises not only the functional capacity of individuals but also their esthetic appearance, phonetics ad overall quality of life.[2] Despite advancements in preventive and restorative dentistry, the prevalence of edentulism is still considerable especially in lower to middle income countries where access to dental care remains limited. In response to this widespread issue the prosthodontics rehabilitation has merged as a critical component of restorative dental practice aiming to restore lost oral functions and improve patient well-being.[3-5]

Over the long period of time conventional complete dentures has been the mainstay treatment for edentulous patients.[6] These prosthesis fabricated to rest on the mucosal surfaces of edentulous ridges are relatively economical, easy to fabricate and widely accessible.[7,8] However they have several limitations including poor retention, instability during function, reduced chewing efficiency and discomfort.[9] Mandibular dentures in particularly tend to pose greater challenges due to limited denture bearing areas and the presence of tongue movements that destabilize the prosthesis during mastication. [10-13]

With the evolution of dental implantology, implant-retained overdentures have become an increasingly popular and clinically validated alternative to conventional complete dentures.[10-16] An implant-retained overdenture is a removable prosthesis supported and retained by implants usually placed in the anterior mandible or maxilla. The use of osseointegrated implants to anchor overdenture has demonstrated remarkable improvements in prosthesis stability, patients satisfactions and masticatory performance. Implant overdenture offer enhanced retention and support thereby overcoming many of the biomechanical shortcomings of traditional complete dentures. [14-17]

Among the various parameters used to evaluate the success of prosthodontics rehabilitation, masticatory efficiency stands out as a critical functional measure. It refers to the ability of an individual to effectively comminute food into smaller particles during mastication thereby facilitating proper digestion and nutrient absorption.[9,11] Masticatory efficiency is influenced by several factors including number and distribution of occlusal contacts occlusal force, neuromuscular control, saliva flow and the stability of the prosthesis. Conventional complete dentures often fall short in optimizing these parameter due to their inherent design limitations. Conversely implant retained overdenture provide a more stable foundation for chewing closely mimicking the functional characteristics of natural dentition.[10,12,13]

However heterogeneity in study designs same populations test materials and measurements techniques complicates the direct comparison of results. Furthermore, much of the existing literature focuses on mandibular overdentures with limited comparative data for maxillary prosthesis. Another limitation is the variation in attachment systems which can independently affect masticatory performance.[10-17] There remains a need for a well-structured comparative studies that quantify the difference in masticatory efficiency between conventional complete dentures and implant retained overdentures. Given the clinical relevance of masticatory efficiency in prosthodontics rehabilitation and the growing adaptation of implant retained overdenture it becomes imperative to systemically evaluate their functional superiority over conventional complete dentures. The present study seeks to address this gap by conducting a direct comparison of masticatory efficiency in patients rehabilitated with either modality.

The primary objective of this study was to compare the masticatory efficiency of conventional complete dentures with that of implant retained overdentures in edentulous patients.

METHODOLOGY

This was Quasi experimental study carried out at the department of Prosthodontics, Rehman College of Dentistry, Peshawar. Ethical approval was obtained. A total of 20 patients participated in this study and were non-randomly assigned to each group. Written informed consent was taken from the participants.

Inclusion Criteria

- Completely edentulous patients aged 50-70 years.
- Patients who received either conventional complete dentures or mandibular implant retained overdentures (2 Implants).
- Patients with good oral hygiene, adequate bone height and neuromuscular coordination and willingly participating in the study.

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Exclusion Criteria

- Uncontrolled systemic diseases, craniofacial deformities or neuromuscular disorders.
- Recent prosthesis insertion or major adjustment within the past month.
- History of temporomandibular joint dysfunction.

The sample size was determined based on the feasibility and availability of eligible patients during study period. The 20 participants were divided equally into two groups:

Group A (n=10): Patients with conventional complete dentures (CCD)

Group B (n=10): Patients with implant-retained mandibular overdentures.

Group A-Conventional complete dentures: Patients in this group used maxillary and mandibular acrylic resin complete dentures fabricated using the following protocol:

- Primary and secondary impressions with proper border molding.
- Recording of jaw relations in centric relation.
- Teeth set in bilateral balanced occlusion using semi-anatomic teeth.
- Trial insertion followed by heat-cured acrylic resin processing.
- Insertion and post-insertion adjustments to optimize comfort and function.

Group B- Implant-retained mandibular overdentures: Patient had two osseointegrated implants placed in the interformainal region of the mandible restored with overdenture by locator or ball attachments,

- Implant diameter and length: 3.5-4.0mm×10-13mm.
- A minimum healing time of 3-4 months post-implant placement.
- Overdenture fabricated with balanced occlusion and similar material as CCD.
- Maxillary dentures were conventional in both groups.
- Prosthesis has been functional use for at least 6 months.

Masticatory Efficiency: Color-Change Chewing Gum test: Due to low resource the color changing was subjectively analyzed. Standard color changing chewing gum which changes from green to red using color reference chart on likert scale from 1-5 as shown in table 1.

Provide each participant with one piece of gum and instruct them to chew it for 30 seconds at a natural pace. Ask them to compared the chewed gum color with reference chart. Based on the perceived color change, they rate their chewing performance.

Participants also rated their chewing satisfaction using visual analogue scale (VAS) on 0-10 scale for their satisfaction with their chewing performance. This subjective test aimed to evaluate self-perceived masticatory function. After comparing their color the participants were asked on scale 0-10, how satisfied are you with your chewing performance based on how well the gum changed the color?

The data was analyzed using SPSS 23.0 version. Descriptive statistics like mean, standard deviation and median were calculated for subjective color change scores (likert scale 1-5) and VAS 0-10. Frequncy and percentage were used for categorical variables such as the distribution of subjective scores. Mann-Whiteny U test was used to compare subjective color change scores between CCD and IRO groups and VAS satisfaction scores between groups. The Spearman's rank correlation coefficient was used to evaluate the correlation between subjective color ratings and VAS scores. A p-value <0.05 was considered statistically significant for all tests.

RESULTS

The mean age presentation for CCD group was 63.0±2.36 years and in IRO group 69.1±0.88 years. Both groups have equal gender distribution. The mean subjective color change score for CCD group was 2.7±0.67 and 4.5±0.53 for IRO group. Mann Whiteny U test showed that participants with IRO group perceived greater color change and hence better chewing ability as shown in table 2.

Table 1: Subjective Rating Scale.

Score	Visual Color	Subjective Interpretation
1	No Change (Green)	Very poor mastication
2	Slightly greenish brown	Poor mastication
3	Moderate change (light brown)	Acceptable mastication
4	Pinkish red	Good mastication
5	Fully red	Excellent mastication

Table 2: Mann Whiteny U test.

Parameters	U-Statistic	p-value
Subjective scores	2.5	0.00024
VAS score	0.0	0.00014

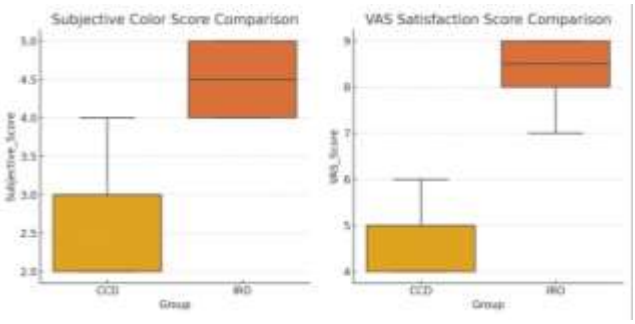

Figure 1: Masticatory efficiency of CCD and IRO.

The mean self-reported VAS score(0-10) for chewing satisfaction was: CCD 4.8±0.79 and IRO:8.4±0.70. A highly significant difference was observed in favor of IRO group as shown in table 2. A very strong positive correlation was observed between subjective color change and the VAS satisfaction score (Spearman's p=0.982, p<0.000001). The participants who perceived better gum color transformation during chewing reported better satisfaction. A side by side comparison of two parameters is shown in figure 1. The figure is showing higher ratings of subjective color change score in IRO users and also a higher satisfaction amongst IRO group.

DISCUSSION

The present quasi experimental study aimed to compare the masticatory efficiency between individuals using conventional complete dentures (CCD) and those rehabilitated with mandibular implant-retained overdentures (IRO). The assessment utilized subjective (color perception and VAS satisfaction) measures. Results revealed a significant superior masticatory performance, subjective perception and satisfaction in IRO group. The correlation further strengthens the conclusion that implant retained prosthesis not only improve biomechanical function but also align with patient-perceived outcomes.

The findings of this study are in consistent with several previous studies that underscores the superiority of implant retained overdenture in enhancing masticatory efficiency. The results of this study are supported by study done by Haas et al[16] and Kapur et al[15]. Our study is laso in consistent with study of Fueki et al[17], who suggested a substantial difference in masticatory efficiency between implant-supported overdentures and traditional complete dentures. In line with our research, Abid et al[18] demonstrated that ball and socket maintained overdentures increased masticatory efficiency. Similar to this investigation, Abid et al[18] used chewing gum wafers. The findings of multiple other research suggested that edentulous patients using implant-supported overdentures had an improvement in their masticatory efficiency.[19-21] This study is consistent with these investigations. Chen et al[22] in their study revealed that the masticatory efficiency of implant supported overdentures are higher than conventional complete denture which is also in agreement with this study. Zahir

et al[23] using chewing gum for masticatory efficiency demonstrated a significant masticatory efficiency which support this study.

Patient's satisfaction was higher in implant retained overdenture as compared to complete denture in this study. Mathew et[24] al study results showed that patient's satisfaction was higher in implant retained overdenture as compared to conventional complete denture which is in agreement with this study. In another study Sagheb et al[25] demonstarted that implant retained overdenture patients have increased masticatory efficiency as compared to implant retained overdenture and these patients are more satisfied than conventional complete denture. The reason could be that implant retained denture have more stability and retention as compared to conventional complete denture.

The strength of this includes its assessment approach equal gender distribution and adherence to inclusion criteria that limit the confounding variables such as systemic disease, neuromuscular impairment or previous implant failure. The standardization of the chewing test (30 seconds) and use of validated gum type and VAS for patient's satisfaction further enhances the reliability of the data.

The limitations of this study include small sample size which limits statistical power and generalizability. The study design itself which introduce potential selection bias. Follow up was limited to a single session. Though the present study provides a compelling evidence supporting the superiority of implant retained overdenture but further studies having larger randomized controlled trials are recommended. Studies needed to assess long-term functional outcomes, comparative analysis across attachment systems, national and systemic health impact, cost effectiveness and patient centered outcomes, impact of cognitive and neuromuscular conditions and digital technology and 3D analysis of implant retained overdenture and conventional complete denture.

The findings of this study have several clinical implications. Patients rehabilitated with mandibular implant retained overdentures demonstrated significantly superior masticatory performance and satisfaction. Clinicians can confidently use color chewing gum and VAS rating as effective low cost tools for assessing denture function. By enhancing ability to chew a wider variety of foods implant supported overdenture support better nutritional intake especially in older adults. This study also support a shared decision making in prosthodontics treatment planning by educating the patients about the functional and satisfaction related advantages of implant supported overdenture.

CONCLUSION

The study concluded that the integration of implant retained overdentures in clinical practices offers functionally superior masticatory function and patient- satisfying solution for complete edentulism reaffirming their role as a cornerstone in prosthodontics.

Recommendations

1. Implant retained overdentures should be considered the first line treatment for edentulous patients.
2. Subjective chewing test (color change gum and VAS) can be integrated monitor treatment success.
3. Patient education should emphasize the functional and health benefits of IRO.

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