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Research Article

Chewing Frequency of Wearers of Removable Partial Denture Restoring Distal Extension Edentulism: Evaluation Among 33 Subjects

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Abstract

Aim/Background: Psycho-functional integration of partial removable prostheses is a complex and multifactorial process. This work aimed to evaluate masticatory frequency of subjects with Removable Partial Dentures (RPD) restoring a distal extension edentulism.

Material and Methods: Evaluation was carried out on 33 volunteers with RPD who were asked to chew two sampled test foods, peanut and raw carrot. The analysis of the chewing kinetic parameters of a normodentate control group allowed comparison data. Chewing frequency data were recorded after viewing the chewing sequence videos and then analyzed on the R® software.

Results: In this sample, 82% of RPD wearers had a Kennedy Class I edentulism. Among them, 54.5% were women and 45.5% of the majority men aged between 46 and 71 years. The subjects who wore their prostheses for 6 months were majority with 57.57% of the population. Regarding the length of edentulism (LE), 42.4% had a small LE, 39.4% a mean LE and 18.2% a large LE. For both test foods, the number of chewing cycles of RPD wearers was twice superior to the average of control group. Chewing time was twice longer for the carrot and three times longer for the peanut.

Conclusion: This study reveals that patients with distal extension edentulism rehabilitated by metal removable prosthesis have a significantly higher chewing frequency than those of normodentate subjects.

Keywords: Partial removable prosthesis, Chewing, Oral health

Introduction

Removable Partial Denture (RPD) is highly anticipated for restoring masticatory function in addition to its objectives of replacing missing teeth and preserving the health of existing structures [1,2]. However, level of functionality of RPD is conditioned by the multitude of possible edentulous situations and different states of existing para-prosthetic structures [3]. With these disparities, different movements destabilizing the removable metal prostheses have been reported by authors [4-6]. TABET describes six fundamental movements of which three are translational and three are rotational [5,6]. These different movements require specific characteristics on the metal prosthesis and can induce a particular physiology of the chewing of wearers of this type of denture.

BESSADET and MALBOSS showed that the stresses to which the prosthesis is subjected will be different according to the number of teeth to be replaced and the type of edentulous [7]. In the case of distal extension edentulism, these constraints are subject to stability defects of the prosthesis that lead to chewing difficulties and changes in eating habits. Indeed, partial edentulous arch has two supporting structures of different compressibility that are teeth and fibromucosa. It is accepted that chewing gradually deteriorates

from a fully toothed maxilla to the state of atrophic edentulous alveolar ridges [7].

Adaptation to increasing food hardness results in an increased number of chewing cycles in normodentate subjects [7-9]. So, in partial edentulism, it's predictable to observe variabilities of chewing according to the food consumed. Evaluation of masticatory parameters of these partially edentulous subjects, such as masticatory frequency could help to describe the functionality of their chewing function. Through the literature, lower masticatory performance was reported with wearers of partial removable prosthesis compared to normodentate subjects [7-13].

As part of prosthetic follow-up, evaluation of the functionality of prostheses remains an obligation and more particularly that of the chewing function. This study aimed to evaluate the chewing of subjects with metal partial dentures restoring a terminal edentulous by comparing them with unmatched tooth control subjects.

Material and Methods

Description of the Study

This is a cross-sectional and descriptive study conducted with rehabilitated patients in the Prosthodontics Clinic of the Institute of Dentistry-Stomatology of Dakar. Telephone calls were used to recruit subjects to participate in this study on a voluntary basis.

Study Population

Included in this study were any topics:

a. wearing a metal partial removable prosthesis rehabilitating a Class I or II Kennedy edentulism.

b. having worn his or her prosthesis(s) for at least three months since the last post therapeutic check-up.

c. Responded positively to telephone call and consented verbally and in writing to participate in this study.

Patients who wore prostheses using prosthetic adhesive, without autonomy or under special diet were not included in this study. Patients who performed control sessions in another structure were excluded from this study.

The sample size was determined using the Schwartz formula for descriptive studies with:

$n = (\varepsilon\alpha)^2 \ Pq/I^2$ where ε= reduced deviation = 1.96; α= risk of error = 0.05; p= theoretical prevalence = 50%. Or q= 1-p = 0.50; I= precision = 4%.

A total of 68 patients were included, including 33 metal partial removable dentures with terminal edentulous and 35 unmatched dentate control subjects. The sampling was random, the selected subjects all had the same chance of being recruited.

Chewing Procedures

All subjects included in the study participated in chewing sessions. They were asked to chew two test foods, peanuts and raw carrot. The latter have a different hardness and consistency, therefore of different rheology and are commonly consumed by the study population. Peanuts were sampled at 3 mm thickness and 5g weight and raw carrots were calibrated with a 3 mm diameter punch at a weight of 4g and in size 2 cm in length. Chewing was to continue until he perceived that the bowl was fit for swallowing. The duration and number of cycles of each chewing sequence were recorded after viewing the chewing sequence videos.

Statistical Analysis

The analysis was performed on the R® software. Quantitative variables were described with extremes, mean and standard deviation and qualitative variables were described with their relative frequencies. Confidence intervals were estimated at 95%. The Shapiro test was used to verify the normality of the distribution. Nonparametric tests (Wilcoxon MW, Spearman, Kruskall Wallis) were used in situations where one of the distributions did not follow a normal law. Apart from these situations parametric tests (Student, ANOVA) were used. The effects associated with our p-value were considered statistically significant at a threshold below 0.05.

Results

Chewing Peanuts

For masticatory frequency, subjects with RPD had a masticatory frequency for peanuts that ranged from 0.71 to 2.78 cycles/s. The mean was 1.45 cycles/s with a standard deviation of 0.38 in a confidence interval between [1.31- 1.59]. Therefore, the mean chewing frequency of controls was 1.70 0.23 with a statistically significant difference (p<0.0006) (Table 1).

Table 1: Peanut Chewing Parameters for Subjects with RPD and Control Group.

Chewing Peanuts : Masticatory Parameters	Population (mean±standard deviation) [confidence interval]		p-value
	RPD Wearers	Control group	
Average Number of cycles	129.6±20.97	52.9±14.08	<0,0001
	[108.64 -150.58]	[48.08 -57.75]	
Chewing time (seconds)	93.5±46	32.04±11.26	<0,0001
	[76.9–100]	[28.17–35.9]	

Masticatory frequency (cycle/s)	1.45±0,38 [1.32–1.59]	1.70±0.23 [1.62–1.77]	0,0006

Chewing Carrot

Masticatory frequency ranged from 0.81 to 2.96 cycles/s. The mean frequency was 1.46 cycles/s with a standard deviation of 0.47 in the confidence interval of [1.29-1.63]. The mean carrot chewing frequency was higher in controls (1.72 0.31), and there was a significant difference between the two groups with p = 0.0058 (Table 2).

Table 2: Raw Carrot Chewing Parameters for RPD Subjects and Control Subjects.

Chewing Raw Carrot: Masticatory parameters	Population (mean±standard deviation) [confidence interval]		p-value
	RPD Wearers	Control Group	
Average number of cycles	137.2±19.35 [117.8–156.5]	68.5±25.44 [59.2–77.9]	<0,0001
Chewing time (seconds)	100.98±49.78 [76.89–110.21]	40.97±16.62 [34.87–47.06]	<0,0001
Masticatory frequency (cycle/s)	1.46±0.47 [1.29–1.63]	1.72±0.31 [1.62–1.84]	0,0058

Prosthetic Parameters and Masticatory Frequency

For Peanuts: Results showed that the average chewing frequency of peanuts could be different depending on the type of prosthesis. The adjusted Dunn test found significant difference between the chewing frequency in individuals with Complete dentures (CD) and RPD (1.51 cycles/s) and those with RPD and Normal dentate (ND) (1.22 cycles/s) with a p-value of 0.033. This difference was also found between masticatory frequency in individuals with RPD/ND (1.22 cycles/s) and individuals with RPD/Resin RPD (2.5 cycles/s). There were no other statistically significant differences in chewing parameters between groups formed by edentulous location, extent, or KENNEDY classification. No correlation was found between masticatory parameters and prosthetic wearing time (Table 3).

Table 3: P-value from the bivariate analysis between prosthetic and masticatory parameters of the peanut.

		Number of Cycles (p-value)	Masticatory Frequency (p-value)
Prosthetic Parameters	Localisation of edentulism	0.175	0.885
	Length of edulism	0.533	0.244
	Edentulism class of KENNEDY	0.907	0.113
	Type of dentures	0.183	0.046
	Denture wearing time	0.218	0.334

Note*: Using of non-parametric test.

Table 4: P-value from bivariate analysis between prosthetic and masticatory parameters of raw carrot.

		Number of cycles (p-value)	Masticatory frequency (p-value)
Prosthetic Parameters	Localisation of edentulism	0.255	0.944
	Length of edentulism	0.754	0.508
	Edentulism Class of KENNEDY	0.755	0.216
	Type of dentures	0.075	0.124
	Denture wearing time	0.222	0.273

Note*: Using of non-parametric test.

For Raw Carrot: The mean D50 was 2mm and 1.67mm respectively in individuals with maxillary edentulism and those with mandibular edentulism. These two averages were statistically different with a p-value of 0.029. For the rest, there was no significant difference between masticatory parameters in the different groups formed according to prosthetic parameters. There were also no correlations between masticatory parameters and prosthetic wearing time (Table 4).

Discussion

For peanuts, parameters of chewing performance (number of cycles and the chewing time) were significantly higher with edentulous subjects than control subjects. These results show that RPD wearers need twice as many chewing cycles and three times more time than normodentate subjects to get a food bowl (peanut) ready to swallow. In fact, studies have shown that rehabilitation with RPD only partially restores chewing function [11,14,15]. However, the chewing frequency observed with subjects with RPD was significantly lower than that of control subjects. This can be explained by greater differences in chewing time observed at the level of edentulous subjects and these had a statistical impact on the confidence interval of these subjects [1.32-1.59], which was wider than that of control subjects [1.62-1.77]. In addition, correlative analysis shows that type of prosthesis had a significant influence on chewing frequency. This result is in contradiction with facts reported by authors who had shown that with multiple and frequent mandibular movements, a mandibular removable prosthesis was subjected to more destabilizations resulting in impaired masticatory function [4-6].

Depending on the type of prosthesis, the chewing frequency of patients with CD/RPD was higher and statistically significant compared to those with RPD/ND with a p-value of 0.033. Same difference is observed with RPD/ND wearers (1.22 cycles/s) and individuals with RPD/ resin RPD (2.5 cycles/s). In both cases RPD/ND wearers have lower frequency compared to other types of prosthesis. So, normodentate subjects have a better masticatory performance. In fact, fragmentation of a bowl of peanuts stated as a destabilizing factor to wearers of removable prosthesis, given the rheological character of this food [16,17].

For carrot, same trend as with peanuts is observed for number of cycles and chewing times. In fact, wearers of RPD did twice as many cycles and time as control subjects. Higher values for number of cycles and chewing time were found in patients with CD/RPD as well as peanuts. These results are similar to those of *MORARU, et al.,* [18] and are easily explained by instability of completed denture related to bone resorption phenomena [19]. Comparative analysis with control subjects showed a significant difference in the number of cycles, time and frequency of chewing, as with peanuts. The higher masticatory muscle activity in removable prosthesis wearers compared to normodentate subjects allows to understand this significant difference [20]. In addition, a pilot study conducted on a population wearer of RPD restoring distal extension edentulism revealed rather long chewing times [12,21,22].

Conclusion

This study reveals that patients with distal extension edentulism rehabilitated by metal removable prosthesis have effective mastication by compensation. Masticatory parameters are significantly higher than those of normodentate in control group.

Acknowledgement

None.

Conflict of Interest

None.

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