

Mastication in Subjects with Extremely Shortened Dental Arches Rehabilitated with Removable Partial Dentures

Jackelyn Arce-Tumbay, DDS, MSD^a/Alfonso Sánchez-Ayala, DDS, MSD^b/
Bruno Salles Sotto-Maior, DDS, MSD^b/Plinio Mendes Senna, DDS, MSD^b/
Nara Hellen Campanha, DDS, PhD^c

Mastication was evaluated in subjects presenting extremely shortened dental arches (ESDAs) rehabilitated with mandibular free-end removable partial dentures (RPDs). Subjects were divided into four groups ($n = 10$): those with a complete dentition, those with ESDAs, and those with ESDAs who were rehabilitated with an RPD, who were evaluated both with and without their prostheses. Mastication was measured through masticatory performance, time, and ability. RPD wearers showed higher masticatory performance ($P < .01$) and ability ($P < .001$) and lower masticatory time ($P < .001$) than when not wearing their prostheses as well as ESDA subjects who had not received RPD therapy. Those with a complete dentition showed the best results ($P < .001$). It can be suggested that RPDs improve mastication in ESDA subjects but without achieving normal mastication levels. *Int J Prosthodont* 2011;24:517–519.

The shortened dental arch concept establishes that the mastication of subjects who present at least premolars is still functional after an adaptive process. Despite reported satisfactory masticatory ability,¹ the evidence regarding masticatory performance in these subjects is weak, and possible alterations in masticatory time resulting from grinding impairment are also unknown.^{2–4}

Moreover, the effect of removable partial denture (RPD) rehabilitation on mastication of subjects presenting extremely shortened dental arches (ESDAs) with only two premolar occlusal units remains unclear.^{1–4} Therefore, the aim of this preliminary study was to evaluate mastication in ESDA subjects who were and were not rehabilitated with RPDs.

Materials and Methods

Thirty male subjects were recruited according to the selection criteria (Table 1) and divided into four groups (Fig 1). ESDA RPD wearers received new conventional distal extension RPDs manufactured with cast metal frameworks (cobalt-chromium; Degudent, Dentsply) and semianatomical artificial teeth (Biotone IPN, Dentsply). Evaluations of ESDA subjects who wore RPDs and were tested with and without their prostheses were done after 8 months of rehabilitation with their new RPDs. A consent form approved by the local ethics committee was signed by all subjects.

Three quarters (approximately 2 g) of an Optosil Plus (Heraeus Kulzer) disk (20 × 5 mm) was offered to each subject, who chewed it for 20 strokes. This procedure was repeated five times. The total particles obtained were rinsed, dried, and passed through a stack of up to 10 sieves (0.5- to 11.2-mm mesh sizes) and shaken for 2 minutes. The retained particles in each sieve were weighed (± 0.01 g). Masticatory performance was evaluated by the median particle size (X_{50}) using the Rosin-Rammler equation.^{2,4} The time to complete the masticatory performance test was recorded in seconds and defined as masticatory time. Masticatory ability was evaluated by a self-perception questionnaire using 10-cm visual analog scales, in which the subjects were asked how well they were able to chew food in general as well as specific foods (fresh carrot, fresh lettuce, firm meat, boiled vegetables, and whole fresh apple).⁵

^aResearcher, Victor Alzamora Castro Graduate School, College of Stomatology, Cayetano Heredia Peruvian University, Lima, Peru.

^bPhD Student, Department of Prosthodontics and Periodontology, Piracicaba Dental School, State University of Campinas, Piracicaba, São Paulo, Brazil.

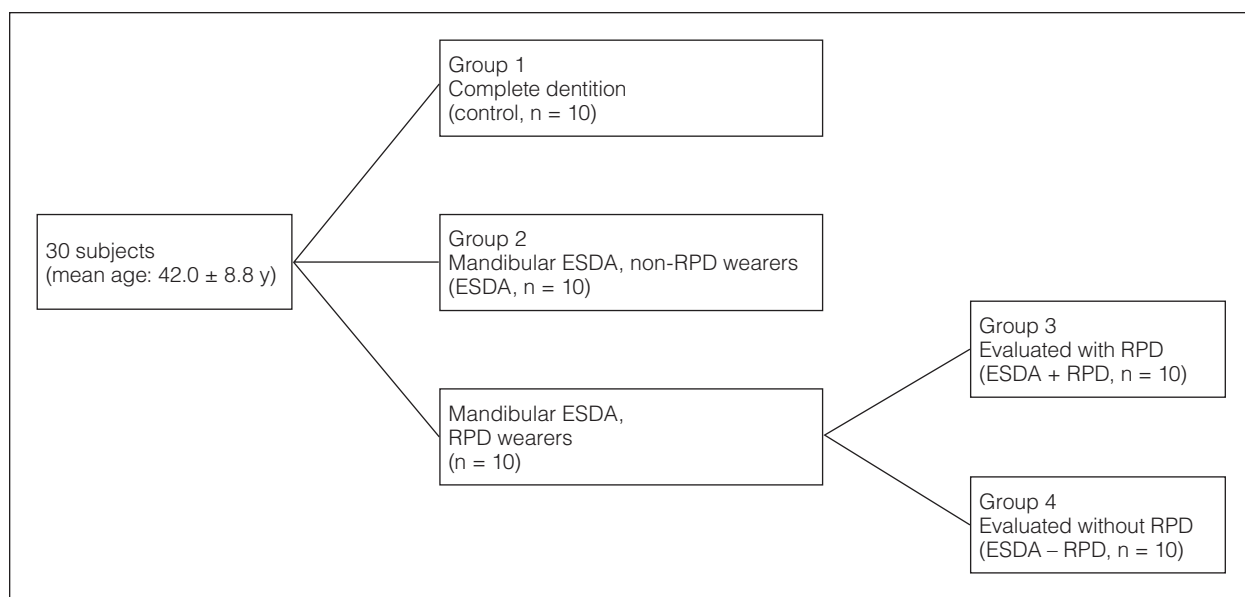
^cProfessor, Department of Dentistry, State University of Ponta Grossa, Ponta Grossa, Paraná, Brazil.

Correspondence to: Dr Nara Hellen Campanha, Department of Dentistry, State University of Ponta Grossa, Avenida General Carlos Cavalcanti, 4748, Ponta Grossa, Paraná, 84030-900 Brazil. Fax: +55-42- 3220-3102. Email: narahell@yahoo.com.br

Table 1 Inclusion and Exclusion Criteria

Inclusion criteria	Exclusion criteria
Good general health	Systemic disease
Normal Body Mass Index (20–25 kg/m ²)	Medical prescription diet
No previous orthodontic treatment	Symptoms of temporomandibular dysfunction
Presence of complete natural dentition (excluding third molars; control group)	Xerostomy
Presence of complete maxillary dentition (excluding third molars) and mandibular Kennedy Class I partial edentulism comprising first premolars*	Prosthetic restorations
	Periodontal disease
	Dental caries

*Subjects presenting this condition suffered from it for 2 to 3 years, considering the time of extraction of the last teeth.

**Fig 1** Sample distribution in this study.

One-way analysis of variance and the Tukey post hoc and paired Student *t* tests were used for statistical analysis ($\alpha = .05$).

Results

The ESDA + RPD group showed higher values of masticatory performance ($P < .01$) and ability ($P < .001$) as well as lower values of masticatory time ($P < .001$) than the same subjects without their prostheses (ESDA – RPD group) and ESDA subjects who did not wear RPDs (Tables 2 and 3).

The control group showed the highest values for masticatory performance and ability ($P < .0001$) and the lowest values for masticatory time ($P < .001$).

Discussion

Despite the mechanical disadvantages and lower sensorial capacity related to subjects with fewer teeth,² a possible adaptation mechanism for those with shortened dental arches was suggested by Aras et al,⁴ who found no differences in masticatory performance between subjects with shortened dental arches and those with a complete dentition or RPD wearers evaluated with and without their dentures. However, in the present study, ESDA and ESDA – RPD subjects showed lower masticatory performance, which may be interpreted as an absence of adaptation or the inability of the test to detect it in ESDA subjects.

Table 2 Masticatory Performance and Masticatory Time (Mean \pm Standard Deviation)*

	Control	ESDA	ESDA + RPD	ESDA - RPD
Masticatory performance (mm)	2.71 \pm 0.05 ^a	4.43 \pm 0.66 ^b	3.56 \pm 0.48 ^c	4.31 \pm 0.76 ^b
Masticatory time (s)	17.68 \pm 0.88 ^a	37.67 \pm 3.83 ^b	24.16 \pm 0.46 ^c	42.20 \pm 3.41 ^d

ESDA = extremely shortened dental arch; RPD = removable partial denture.

*Mean values in each column followed by different letters differ statistically ($\alpha = .05$).**Table 3** Masticatory Ability (Mean \pm Standard Deviation)*

Group	Food in general	Fresh carrot	Fresh lettuce	Firm meat	Boiled vegetables	Whole fresh apple
Control	9.9 \pm 0.1 ^a	10.0 \pm 0.0 ^a	10.0 \pm 0.0 ^a	9.5 \pm 0.4 ^a	10.0 \pm 0.0 ^a	9.9 \pm 0.2 ^a
ESDA	5.9 \pm 0.9 ^b	6.1 \pm 0.5 ^b	7.4 \pm 1.3 ^b	3.9 \pm 1.5 ^b	6.7 \pm 1.2 ^{b,c}	5.5 \pm 0.4 ^b
ESDA + RPD	6.3 \pm 1.0 ^b	6.3 \pm 1.5 ^b	8.0 \pm 1.6 ^b	4.9 \pm 1.2 ^b	7.5 \pm 1.0 ^b	5.0 \pm 1.0 ^{b,c}
ESDA - RPD	4.2 \pm 1.7 ^c	3.2 \pm 1.4 ^c	4.3 \pm 2.4 ^c	3.7 \pm 1.6 ^b	6.1 \pm 1.4 ^c	3.9 \pm 2.1 ^c

ESDA = extremely shortened dental arch; RPD = removable partial denture.

*Mean values in each row followed by different letters differ statistically ($\alpha = .05$).

The results for the ESDA + RPD group suggest that ESDA subjects are rehabilitated with RPDs to not only improve their masticatory performance but also to reduce their masticatory time. Jemt et al³ found higher mandibular velocity after RPD rehabilitation, which may be explained by the increased number of occlusal surfaces, which favors the selection and breakdown of food.²

Masticatory ability was lower in ESDA subjects, but this group did not present worse results than the ESDA + RPD group. It could be considered that the questionnaire was able to detect some degree of adaptation for ESDA subjects, since the ESDA - RPD group had lower values of masticatory ability. However, this possible adaptation would be weak when hard foods such as firm meat are evaluated.

Conclusion

Although RPD rehabilitation did not improve the masticatory ability of ESDA subjects, it is suggested that RPDs improve masticatory performance and masticatory time; however, RPD treatment does not reach the mastication values of subjects with complete dentitions.

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