

Shortened Dental Arch: Clinical Evaluation of Temporomandibular Disorders and Oral Comfort in Older People

Kısalmış Dental Ark: Yaşlı Bireylerde Temporomandibular Düzensizlikler ve Oral Konforun Klinik Olarak Değerlendirilmesi

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ABSTRACT Objectives: The aim of this study was to evaluate oral comfort of older people with shortened dental arch (SDA) regarding temporomandibular disorders (TMD), masticatory ability, and aesthetic complaints and analyze its association to age and gender. **Material and Methods:** The study group consisted of 163 subjects with SDA and 44 subjects with complete dental arches that had uninterrupted dental arches which consisted of intact anterior regions and from 3 to 5 occlusal units in the posterior area. The section of the questionnaire enquired about socio-demographic data, including age, gender, duration of SDA, TMD (self-reported pain, joint sounds/ clicking, and restricted mobility), masticatory ability (self-reported chewing difficulties, chewing much time, use special food, unilateral and/or front-chewing), and aesthetic complaints (self-reported avoid laughing/smiling, avoid conversation, and appearance general health). Analysis included frequency, cross tabulations, calculation of means Spearman's Rho and chi-square test. **Results:** Total of 207 patients, 92 males, 115 females, (mean age; 60.11 ± 7.94 years) were recruited for the study. Female subjects with SDA reported pain more frequently than male subjects (p< 0.05). 'Chewing difficulties' was reported significantly more frequently by male subjects than females with SDA (p< 0.05). Unilateral chewing or front-chewing (p< 0.05), all aesthetic complaints (avoid laughing/smiling, avoid conversation, and appearance health), (p< 0.001) were reported significantly more frequently by female subjects than males with SDA. No significant differences were found between the older and younger groups with shortened dental arches regarding temporomandibular disorders. Significant results, due to a high incidence in the younger female SDA group were found for aesthetic complaints (p< 0.05). Subjects with 3 occlusal unit reported pain more frequently than did subjects in the other categories of dental arches; this difference was statistically significant (p< 0.001). **Conclusion:** Pain were significantly reported more frequently by female subjects. Age is negatively associated with changes in aesthetic complaints and, appearance health in all types of SDA. Aesthetic complaints and appearance health were significantly reported more frequently by all types of SDA. The oral comfort of subjects with SDA was compromised to a small extend but remained on an acceptable level.

Key Words: Temporomandibular joint disorders, stomatognathic system

ÖZET Amaç: Bu çalışmada, kısalmış dental arka (KDA) sahip yaşlı bireylerde oral konfor ile ilgili olarak temporomandibular düzensizlik (TMD)'ler, çiğneme yeteneği ve estetik kaygılar ile bu bulgularla ilgili hasta yakınmaları kendi ifadeleri ile kaydedilerek, yaş ve cinsiyet açısından değerlendirilmesi amaçlandı. **Gereç ve Yöntemler:** Çalışma grubu KDA bulunan 163 hasta ve diş eksikliği bulunmayan 44 hasta, anterior bölgede eksikliği bulunmayan ancak posterior bölgede 3 ile 5 oklüzal ünite eksikliği bulunan hastalardan oluşmaktadır. Bu çalışmada oral konfor ana başlığı altında; TMD, çiğneme yeteneği ve estetik yaklaşımlara ait bulgular hastaların yakınmaları dikkate alınarak, soru-cevap şeklinde değerlendirildi. İstatistiksel analiz için ki-kare testi kullanılmıştır. **Bulgular:** Çalışmamızda toplam 207 hasta; 92 erkek, 115 kadın; yaş ortalaması; 60 ± 7.94 yıl olarak değerlendirilmiştir. KDA bulunan kadınlarda 'ağrı' bulgusu erkeklere oranla istatistiksel olarak anlamlı şekilde daha sıklıkla bildirildi (p< 0.05). Diğer TMD bakımından, KDA bulunan genç ve yaşlı gruplar açısından anlamlı bir fark görülmemiştir. KDA bulunan genç kadınlarda estetik kaygılar ve genel sağlık ile ilgili yakınmalar istatistiksel olarak anlamlı bir şekilde yüksek oranda bulunmuştur (p< 0.05). Üç oklüzal ünite eksikliği bulunan hastalarda ağrı bulgusu diğer kategorilerdeki diş eksikliklerine oranla ağrı bulgusu daha sık bildirilmiştir (p< 0.001). Çiğneme gücü bulgusu ve tek taraflı ve/veya ön dişlerle çiğneme bulgusu ise 3 oklüzal ünite ve 5 oklüzal ünite eksikliği bulunan hastalarda diğer kategorilere göre daha fazla bildirilmiştir. Estetik kaygılar ile ilgili yakınmalar ve genel sağlık durumu ile ilgili yakınmalar ise 3 oklüzal ünite ve 4 oklüzal ünite eksikliği bulunan hastalarda diğer kategorilere göre daha fazla bildirilmiştir. **Sonuç:** Ağrı bulgusu kadınlarda anlamlı şekilde daha fazla bildirilmiştir. Yaş ise bütün SDA tiplerinde estetik kaygılar ve genel sağlığın etkilenmesi bulguları ile negatif ilişkili bulunmuştur. Estetik kaygılar ve genel sağlığın etkilenmesi ile ilgili yakınmalar ise tüm SDA tiplerinde daha fazla bildirilmiştir. Oral konforun KDA'ya bağlı olarak olumsuz etkilendiği ancak bunun kabul edilebilir düzeyde olduğu söylenebilir.

Anahtar Kelimeler: Temporomandibular eklem düzensizlikleri, çiğneme sistemi

Oral comfort is considered a part of the quality of a life for a person and is becoming more important in evaluating the oral function. Oral comfort is related to dental health and the dental state, and also has social and psychological effects.¹ Masticatory performance is closely related with the number of teeth. Impaired masticatory ability occurs when the patient has less than 20 well-distributed teeth.^{2,3} Masticatory ability and associated changes or shifts in food selection are manifested only when there are less than 10 pairs of occluding teeth.⁴ The World Health Organization stated that lifelong retention of a functional, esthetic and natural dentition of more than 20 teeth while not requiring prostheses should be the treatment goal for oral health.⁵

A number of terms are used in this context (e.g. chewing or masticatory ability, efficiency, effectiveness, performance). Some authors seem to use these terms as synonyms.⁶⁻⁹ The literature on masticatory efficiency and masticatory ability over the past 50 to 60 years can be separated in to 2 broad categories, subjective and objective evaluations.¹⁰ In this study, 'ability' will be used mainly for an individual's own assessment of their masticatory function.

The term "shortened dental arches (SDA)" was first used in 1981 by the Dutch prosthodontist Arnd Kayser for a dentition with the loss of posterior teeth.¹¹ After clinical studies, he concluded that there is sufficient adaptive capacity in subjects with SDA when at least four occlusal units (OU) are left (one unit corresponds to a pair of occluding premolars; a pair of occluding molars corresponds to two units). The shortened dental arch concept was accepted by a great majority of dentists but not widely practiced.^{3,4,12-16}

When the posterior support is absent, mandibular over closure, changes in the position of condyles and an increased load to the joints were considered to be responsible for TMD.^{17,18} It was reported that the severity of TMD symptoms increases with a decrease in the number of occluding teeth.^{19,20} Masticatory function may commonly be affected in older adults. Previous studies have demonstrated that age, per se, is not necessarily asso-

ciated with a loss of masticatory function.^{9,21} Maintenance of most molars and premolars will ensure occlusal stability, adequate muscle support and joint function and masticatory ability. Tooth losses is usually considered to be a predisposing factor to TMDs.^{22,23} Additionally, the number of remaining teeth or occluding pairs of teeth is correlated with the presence of TMDs.^{9,17,24,25}

This study was conducted to establish if SDA (3 OU, 4 OU, 5 OU, and 12 OU-control group-) is associated with symptoms of functional disturbances of the oral comforts and in particular, with TMDs. A randomized series of subjects drawn from general older population were used in this study.

MATERIAL AND METHODS

This study was carried out with patients who were admitted to the Kırıkkale University Faculty of Dentistry. The protocol was approved by the Ethics Committee of the Kırıkkale University, Faculty of Dentistry. Patients were included in the study after giving their informed consent. Subjects with shortened dental arches were invited to join this study. Exclusion criteria; patients for whom documentary evidence showing that the tooth under investigation had been unopposed for the minimum period of 10 years was unavailable. Patients with unopposed teeth that were prevented from independent movement by involvement in the support or retention for fixed or removable prostheses were excluded.

One hundred sixty-three subjects with shortened dental arches and forty four subjects with complete dental arches (control group) had uninterrupted dental arches (unless replaced by fixed and/or removable prostheses) which consisted of intact anterior regions and from 3 to 5 OU in the posterior area. One occlusal unit was defined as a pair of occluding premolars; occluding molars were considered to be equivalent to 2 occlusal units.^{4,11,12} Fifty two (25.1%) subjects in the study group had 3 OU, 63 (30.4%) had 4 OU, 48 (23.2%) had 5 OU and 44 (21.3%) 12 OU (control group), (Figure 1). The association of age ($\geq 50-60$ years, and > 60 years) with the two summary variables

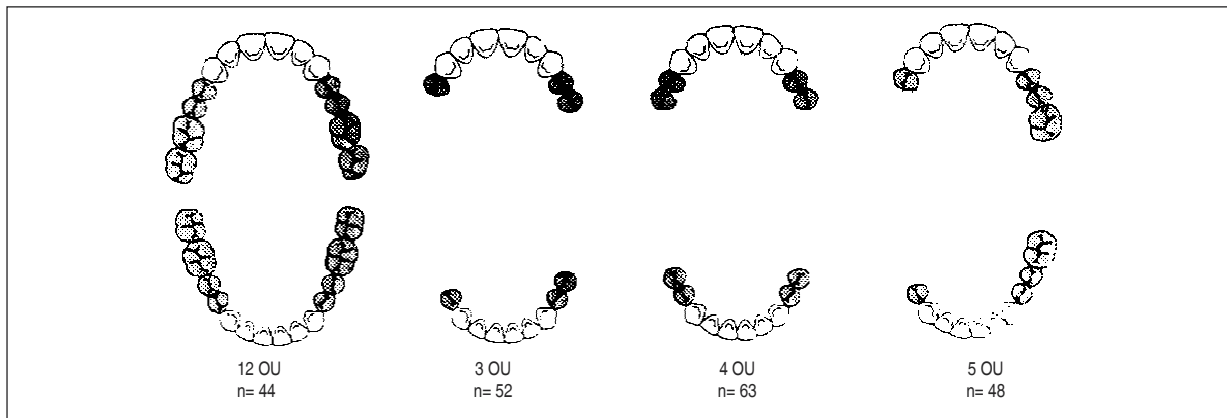


FIGURE 1: Representation of the SDA group (n = 163). The variation of OU is shown in shaded teeth.

was examined. Relevant cross-tabulation analysis was done.

In order to evaluate oral comfort regarding TMD, masticatory ability, and aesthetic complaints, a self-administered questionnaire was given to the participants.^{4,12,13,24,26} The first section of the questionnaire enquired about socio-demographic data, including age, gender, duration of SDA, TMD (Self-reported pain, self-reported joint sounds/clicking, self-reported restricted mobility) The second section included questions regarding the masticatory ability (Self-reported chewing difficulties, self-reported chewing much time, self-reported use special food, self-reported unilateral and/or front-chewing). The third section of the questionnaire included questions regarding aesthetic complaints (self-reported avoid laughing/smiling, self-reported avoid conversation, and self-reported appearance general health). Each subject underwent a comprehensive dental examination by one of the examiners (IB).

The data were analyzed using SPSS for Windows version 12.0 (SPSS Inc, Chicago, Illinois, USA). Analysis included frequency, cross tabulations, calculation of means Spearman's Rho and Chi-square test. Significance was set at the 5% level.

RESULTS

Table 1 shows distribution of the subjects with SDA (n= 163) and the control group (n= 44), regarding to age and gender.

TABLE 1: Distribution of the subjects with SDA (n= 163) and the control group (n= 44), regarding to age group and gender.

SDA	Age	Gender	
		Male	Female
3 OU	≥ 50-60	9	19
	>60	12	12
4 OU	≥ 50-60	8	15
	>60	17	23
5 OU	≥ 50-60	15	12
	>60	5	16
12 OU (control group)	≥ 50-60	12	12
	>60	14	6
Total		92	115

SDA: Shortened dental arch, OU: Occlusal units.

92 males, 115 females; mean age at baseline 60.11 ± 7.94 years. Of these subjects about 19.7% had a SDA for 10-14 years, 35.2% for 15-20 years and 44.4% for 20 years or more. Table 2 shows the distribution of the subjects with SDA, regarding the duration of existence of the SDA and the age group.

Table 3 presents the perceived oral comfort and gender of the subjects with SDA ≥50-60 years old female subjects with SDA reported pain more frequently than male subjects. The difference was statistically significant ($p < 0.05$). Joint sounds/clicking and restricted mobility was reported significantly more frequently by female subjects than males with SDA, with the difference was not statis-

TABLE 2: Distribution of the subjects with SDA, regarding the duration of existence of the SDA and the age group: n and %.

Duration of SDA (years)	Gender	Age				Total	
		≥ 50-60 years		>60 years		n	%
		n	%	n	%		
10-14	Male	11	5.3	3	1.4	14	6.7
	Female	16	7.7	11	5.3	27	13.0
15-19	Male	12	5.8	18	8.7	30	14.5
	Female	21	10.1	22	10.6	43	20.7
20+	Male	21	10.1	27	13.0	48	23.1
	Female	21	10.1	24	11.2	45	21.3
Total		102		105		207	

SDA: Shortened dental arches

TABLE 3: The distribution and of the subjects with SDA regarding oral comfort and age.

Reported oral comfort (n)		Age				p
		≥ 50-60 years		> 60 years		
		Male	Female	Male	Female	
TMJ function	Pain	11	39 *	9	11	< 0.05
	Joint sound/ Clicking	7	19	9	10	0.35
	Restricted mobility	4	12	6	8	0.20
	Chewing difficulties	3	1	4	1	0.29
Masticatory Ability	Use special food	0	3	2	1	0.87
	Unilateral/front chew.	10	21	10	18	0.12
Aesthetic complaints	Avoidlaughing/smiling	3	19*	3	15	< 0.05
	Avoid conversation	2	16	1	11**	< 0.001
	Appearance of health	3	18*	17	32	< 0.05

*p< 0.05

**p< 0.001

SDA: Shortened dental arches, TMJ: Temporomandibular joint

tically significant. Chewing difficulties were reported significantly more frequently by male subjects than females with SDA, with the difference was not statistically significant. Use special food, and unilateral chewing and/or front-chewing equal reported by male subjects and females with SDA, with the difference was not statistically significant. Avoid laughing/smiling ($p < 0.05$), avoid conversation ($p < 0.001$), and appearance health ($p < 0.05$) were reported significantly more frequently by female subjects than males with SDA, with the difference being statistically significant.

Table 4 presents the perceived oral comfort (TMJ function, masticatory ability, and aesthetic complaints) of the subjects with SDA ($n = 163$). Sub-

jects with 3 OU reported pain more frequently than did subjects in the other categories of dental arches; this difference was statistical significant ($p < 0.001$). Joint sounds/clicking were reported significantly more frequently by all subjects with SDA (3 OU, 4 OU, 5 OU) compared to the control group (12 OU) ($p < 0.001$). Restricted mobility was reported more frequently in subjects with SDA (3 OU, 4 OU, and 5 OU) than in the control group (12 OU), but the difference was not statistically significant. Chewing difficulties were reported significantly more frequently by all subjects with SDA (3 OU, 4 OU, 5 OU) compared to the control group (12 OU) ($p < 0.05$). Use special food was reported more frequently in subjects with SDA (3 OU, 4 OU,

TABLE 4: The distribution and of the subjects with 3 OU, 4 OU, 5 OU and 12 OU (control group) regarding oral comfort.

Reported oral comfort (n)		3 OU	4 OU	5 OU	12 OU	p
TMJ function	Pain	36**	24	22	2	< 0.001
	Joint s./Clicking	11*	11*	13*	2	< 0.001
	Restricted mobility	10	8	6	1	0,122
Masticatory ability	Chewing difficulties	9*	11*	11*	0	0.05
	Use special food	3	1	2	0	0.27
	Unilat./front-chew.	17**	12	22**	0	< 0.001
Aesthetic complaints	Avoidlaugh/smiling	18**	12**	10	0	< 0.001
	Avoid conversation	15**	12**	5	1	< 0.001
	Appearance of health	23**	30**	8	9	< 0.001

*p< 0.05

**p< 0.001

TMJ: Temporomandibular joint, OU: Occlusal units

and 5 OU) than in the control group (12 OU), but the difference was not statistically significant. Unilateral chewing and/or front-chewing were reported significantly more frequently by SDA subjects with 5 OU and 3 OU than 12 OU; the difference was statistically significant ($p < 0.001$). A statistically significant high incidence in the 3 OU and 4 OU with SDA groups were found for aesthetic complaints (avoid laughing/smiling, $p < 0.001$, avoid conversation, $p < 0.001$) and appearance health ($p < 0.001$).

DISCUSSION

SDA concept is still considered controversial by many clinicians. For example, SDA has long been reported by clinicians to lead to mandibular displacement and various changes in the body. SDA has also been suggested to be associated with an increased risk for changes in the temporomandibular joint (TMJ).^{23,25} The higher prevalence of TMD for women in the present study is confirmed by numerous epidemiologic studies.²⁷⁻³¹ Therefore, women and men were analyzed separately because gender seems to have a great influence on the development of functional disturbances. In this study, pain were significantly reported more frequently by female subjects ($p < 0.05$) and female subjects with SDA reported unilateral chewing or front-chewing more frequently than male subjects.³² All aesthetic complaints and appearance health were reported significantly more frequently by female subjects than male with SDA ($p < 0.001$). The higher num-

ber of TMD signs in females may be due to a higher biologic sensitivity to stimuli.^{29,30,33} Women may detect signals that men might not notice.³⁴ In terms of the biologic background, the higher number of estrogen receptors in the female TMJ itself has been suggested to be important in the gender differences.³⁵ Recent reports have shown a significant influence of the menstrual cycle on musculoskeletal pain.³²

In this study; younger patients with SDA, some reported various chewing problems. However, most patients with SDA had no or only minor problems with chewing.¹⁵ This study showed that in the subjects with SDA, the younger age group (≥ 50 - ≤ 60 years) had significantly higher mean scores ($p < 0.05$) for pain than did the older age group (> 60 years). Johansson et al also found a higher prevalence of TMD pain in the 50-year-old group as compared with the 60-year-old group.³⁶ Also, another authors suggested that subjects aged 45 to 54 years had significantly less muscle tenderness or pain in relation to the younger group.³⁶⁻³⁹ These findings agree with a report that found muscle disorders to be more frequent in younger patients.¹⁷ Tallents et al suggested that a positive association between missing mandible posterior teeth and the presence of disk displacement existed.²³ The mechanism for this relation is not yet fully understood but it has been suggested that orofacial and TMD pain may share the major characteristics of other chronic pain conditions in other areas of the body.^{36,40} The significant results of the current

study, due to a high incidence in the younger female SDA group were found for aesthetic complaints (avoid laughing/smiling, $p < 0.05$, avoid conversation, $p < 0.001$, and appearance health $p < 0.05$). The important contribution of masticatory ability to general health is not well realized even when restriction in dietary selection might impinge upon the function of the gastrointestinal tract.^{9,41}

De Boever et al signaled the role of molar support in preventing TMD.¹⁷ Kirveskari and Alanen found a significant association between the loss of the first maxillary premolar and TMD.⁴² Pullinger et al found an increased risk of TMD in subjects with more than five or six missing posterior teeth.²⁰ On the other hand, other authors did not confirm that correlation.^{24,43} The current study suggests that the subjects with 3 OU reported pain more frequently than did subjects in the other categories of dental arches ($p < 0.001$). Joint sounds were reported significantly more frequently by all subjects with SDA (compared to the complete arches ($p < 0.05$)). Greater chewing time was reported more frequently in subjects with SDA than in the control group ($p < 0.05$). Unilateral chewing and/or front-chewing were reported significantly more frequently by SDA subjects than control group ($p < 0.001$). The present results support such an association with a high incidence in the 3 OU and 4 OU with SDA groups for aesthetic complaints [(avoid laughing/smiling, avoid conversation, and appearance health ($p < 0.001$))]. Previous studies have employed SDA as associated with impaired oral function. Oosterhaven et al reported that the number of occlusal contacts in the premolar area were more important than the missing premolars in terms of chewing performance.⁴⁴ Leake, in developing an index of chewing ability, found that the most important factors in determining chewing abi-

lity were the number of opposing pairs of posterior teeth followed by the number of functional premolar pairs.²⁷ Some studies described the fact that the loss of a molar tooth was associated with more pain and dysfunction in the TMJ.^{19,34} In some reviews, the effect of the loss of posterior molar support on TMJ pathology has been discussed.^{20,28} Maintenance of most molars and premolars will ensure occlusal stability, adequate muscle support and joint function and masticatory ability.¹¹ Tooth loss is usually considered to be a predisposing factor to TMDs. Additionally, the number of remaining teeth or occluding pairs of teeth is correlated with the presence of TMD.^{9,17} Tallents et al showed that a positive association between missing mandibular posterior teeth and the presence of disk displacement was found.²³ Although the literature does not suggest that replacement of these teeth will prevent the development of TMDs, their absence may accelerate the development of degenerative joint disease.²³ Experimental and autopsy studies indicate degenerative changes of the articular tissue because of tooth loss.^{45,46} In our study, however, SDA, consisting of 3-5 OU, provide occlusal comfort.

CONCLUSION

Pain were significantly reported more frequently by female subjects. Age is negatively associated with changes in aesthetic complaints and, appearance health in all types of SDA. The oral comfort of subjects with SDA was compromised to a small extent but remained on an acceptable level.

If prosthetic treatment is considered necessary for patients with the shortened dental arches treatment should be based on predetermined goals and should only be started after careful planning and when initial reversible therapy has proven to be effective.

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