Effects of Dental Extraction on Cognitive Functions in the Elderly

Yaşlılarda Diş Çekiminin Kognitif Fonksiyonlar Üzerine Etkisi

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ABSTRACT

Objective: Dental extraction can be a cause of short-term cognitive decline in elderly patients. In this research, we aimed to evaluate cognitive functions using the Mini-Mental State Examination before and after tooth extraction in elderly patients who have undergone dental extraction with local anesthesia.
Methods: A group of 40 randomly selected patients >65 years old who underwent dental extraction were included. Mini-Mental State Examinations were performed before and after dental extraction.
Results: The patients' total Mini-Mental State Examination scores after dental extraction were statistically significantly lower than the patients' scores before extraction ($p < 0.0001$).
Conclusion: The results of this study suggest that tooth extraction can be a cause of short-term cognitive decline in elderly patients. However, the possibility that loss of teeth is another contributing factor to long-term cognitive decline should be evaluated in further comprehensive clinical studies.

Key Words: Elderly, Tooth extraction, Cognitive functions

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ÖZET

Amaç:.Diş çekimi yaşlı hastalarda erken dönem kognitif yetersizlik nedeni olabilir. Bu çalışmada, lokal anestezi ile diş çekimi yapılan yaşlı hastalarda diş çekimi öncesi ve sonrasında Mini Mental Durum Değerlendirme testi ile kognitif fonksiyonların değerlendirilmesi amaçlanmıştır
Yöntem: Rastlantısal olarak seçilmiş 65 yaş üstü, 40 adet diş çekim hastası bu çalışmaya dahil edilmiştir. Mini Mental Durum Değerlendirme Testi diş çekimleri öncesinde ve sonrasında gerçekleştirilmiştir.
Bulgular: Hastaların diş çekim sonrası Mini Mental Durum Değerlendirme test değerleri diş çekim öncesi değerlerinden istatistiksel olarak anlamlı ölçüde düşük olarak saptanmıştır ($p < 0.0001$).
Sonuç: Bu çalışmanın sonuçları diş çekiminin yaşlı hastalarda erken dönem kognitif yetersizlik nedeni olabileceğini ortaya koymaktadır. Bununla birlikte, diş kaybının uzun dönem kognitif yetersizliğe katkıda bulunabilecek bir faktör olma ihtimali daha kapsamlı klinik çalışmalarla değerlendirilmelidir.

Anahtar Sözcükler: Yaşlı; Diş çekimi; Kognitif fonksiyonlar

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INTRODUCTION

Cognitive functions are defined as the mental processes of knowing and include aspects such as awareness, perception, reasoning, and judgement. These functions are affected by several internal and external factors. Research into the nature and causes of cognitive impairment have focused on identifying factors that have the potential to decrease the risk of individuals experiencing cognitive decline (1).

Forms of cognitive decline, such as memory impairment or attention deficits, are associated with aging (2). Numerous neurobiological, psychological, and social factors may contribute to age-related cognitive impairments (1-4).

Tooth extraction is the removal of teeth from the dental alveolus in the alveolar bone, and extractions are performed for various reasons. In the elderly, teeth are commonly lost as a result of dental caries or inflammatory periodontal diseases that lead to periodontal tissue loss, both of which are caused by exposure to a bacterial biofilm.

Many studies have suggested that tooth loss can exacerbate cognitive impairment in the long term (4-6). In the present prospective clinical observational study, our aim was to evaluate the relationship between tooth extraction and cognitive functions in patients over 65 years old. For this purpose, cognitive functions were evaluated using the Mini-Mental State Examination (MMSE) (7) before (B) and after (A) a dental extraction procedure has been performed. Our clinical observational research suggests that tooth extraction promotes cognitive decline in elderly patients immediately after dental extraction. The proposed model provides a rationale for conducting further experimental and clinical studies.

MATERIALS and METHODS

This study was approved by the local Institutional Review Board and was conducted at two centers (Ankara University Faculty of Dentistry and Ankara 75th Yıl Oral and Dental Health Hospital). The study was conducted in accordance with the Declaration of Helsinki guidelines and Good Medical Practice Guidelines. The study included 40 dental patients over 65 years old who were classified as American Society of Anesthesiologists (ASA) Physical Status I–II and who had undergone tooth extraction under local anesthesia. All patients were informed about the study protocol and dental extraction procedure. They were enrolled in the study after signing a written informed consent form. All patients had various indications for tooth extraction, including increased mobility, presence of deep caries, and attachment loss. Patients with a medical contraindication to minor oral surgery or neurological diseases were excluded. Gender, the level of education, the duration of the extraction procedure, presence of systemic diseases, and number of extracted tooth were recorded.

The MMSE was used to screen for possible cognitive impairment before and after performing tooth extraction. In the present study, the MMSE was used, with a scale from 0 to 30, with 30 indicating the best level of cognitive function, as in the full version. Previous studies have suggested that changes of ≥2 and ≤3 points or ≤2–4 points indicated reliable change at a 90% confidence level (8,9). We therefore defined a decline of ≥3 in the MMSE scores between before extraction and after extraction to be suggestive of a possible decline in cognitive function.

Before extraction, the patients were seated in a dental unit, and MMSEs were administered to obtain baseline cognitive values [Before (B)]. Following local anesthesia (articaine) administration (Maxicaine fort® 2 ml, Vem İlaç, Ankara, Turkey), the extraction procedure was performed. After extraction, alveolar compression was applied, and the region was sutured with resorbable suture material (Pegelak 3/0, Doğsan, Trabzon, Turkey). In all patients, the procedures were successfully performed without any complications. For each patient, the entire procedure took <30 min. At 2 h postoperatively, cognitive functions were evaluated by the MMSE [After (A)], and cognitive values representing the postextraction time were obtained. After the completion of the procedure, the patients were discharged after postoperative instructions were provided. Extraction procedures and cognitive assessments were performed by the same researcher.

Statistical analyses were performed using version 20.0 of the SPSS program, and results are presented as mean ± SD, range (Min–Max), and number [n (%)]. A p-value of <0.05 was considered to indicate statistical significance. Scores before and after extraction were assessed using the paired t-test.

RESULTS

The data of all patients (n = 40) were included in this study. The patients' characteristics are presented in Table 1 (Table 1. Age, gender, ASA physical status, number of extracted tooth, procedure time, side effects or complication variables of the patients). The entire procedure took 11.38 ± 4.38 min for each subject, and tooth extraction procedures were successfully performed in all patients without encountering any complications. Before and after dental extraction, MMSE scores (B versus A) were compared [Table 2. MMSE variables before dental extraction (B) as the baseline and after dental extraction (A); Figure 1. MMSE variables before and after dental extraction].

Table 1: Age, gender, ASA status, number of extracted tooth, procedure time, side effect or complication variables of the patients [Mean±SD, (Min-Max), n (%)].

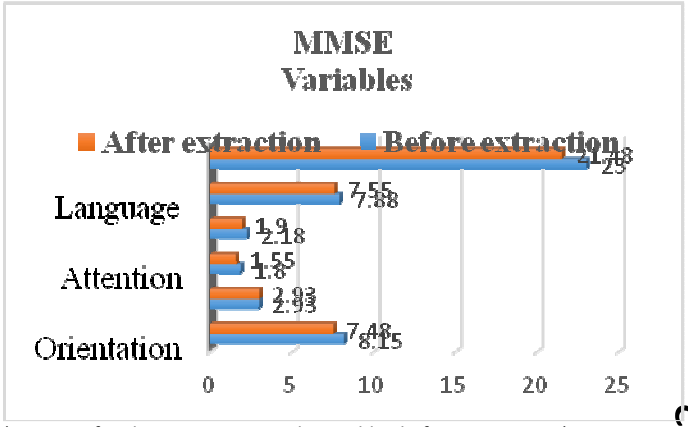
Variables	
Age (year)	70,25±5,40 (65-87)
Gender (M/F)	30/10 (75-25)
ASA physical status (I/II)	10/30 (25-75)
Number of the extracted tooth	1,60±0,77 (1-5)
Procedure time (minute)	11,38±4,38 (5-30)
Side effect or complication (+/-)	0/40 (0/100)

Table 2: MMSE variables in terms of before extraction [Before (B)] and after extraction (A)
[Mean±SD, (Min-Max)]

Subgroups of MMSE variables	B	A	P	%95 (CI)
Orientation	8,15±1,81 (3-10)	7,48±2,05* (3-10)	<0,0001	0,465-0,884
Registration	2,93±0,27 (2-3)	2,93±0,27 (2-3)	1,000	-0,007-0,007
Attention	1,80±0,33 (0-3)	1,55±0,31* (0-3)	0,016	0,048-0,451
Memory	2,18±0,84 (0-3)	1,90±1,08* (0-3)	0,047	0,004-0,545
Language	7,88±1,01 (5-9)	7,55±1,04* (5-9)	<0,0001	0,173-0,476
Total	23,00±4,36 (13-30)	21,48±4,60* (12-30)	<0,0001	1,177-1,872

*P ≤ 0.05 correspondence with before extraction variables

Figure 1. MMSE variables before and after dental extraction



*P ≤ 0.05 for the comparison with variables before extraction (Orientation, Attention, Memory, Language, Total)

DISCUSSION

Various factors have been proposed in relation to cognitive decline in the elderly. However, only some factors contributing to cognitive decline are known to be definitely involved. Cardiovascular disease, vascular risk factors, inflammation, sensory impairments including visual and auditory domains, decreased physical activity, and low education level have been shown to be strongly associated with cognitive decline (1,4,10-12).

The present clinical observational study suggests that dental extraction in elderly patients promotes cognitive decline immediately after dental extraction. In our patients, MMSE scores taken after dental extraction were lower than the scores before extraction, and it is important to note that MMSE scores will increase in repetitive applications as the subjects learn from the test (7).

The results from previous studies support a relationship between dental status and cognition (13-15). Research in humans has shown that chewing activates blood flow in many regions of the brain (16); on the other hand, multiple tooth loss and difficulty in chewing hard food has been found to be linked with significantly high odds of cognitive impairment in the elderly (13). Onozuka et al. (17) reported that chewing causes regional increases in neuronal activity in the brain. Some of these changes have been found to be age-dependent. Sesay et al. (18) demonstrated a significant increase in regional cerebral blood flow during mastication in humans. These results support an association between chewing ability and cognitive impairment.

Among older Chinese adults, Luo et al. (14) concluded that having over 16 missing teeth was associated with severe cognitive impairment. Furthermore, sex, age, years of education, living alone, body mass index, cigarette smoking, alcohol drinking, anxiety, depression, heart disease, hypertension, diabetes, and APOE-ε4 are significantly associated with dementia. Li et al. (15) reported that cognitive decline and number of teeth remaining are interrelated among older adults. Similar to these studies, Peres et al. (19) found an association between tooth loss and severe cognitive impairment and observed that older adults seemed to be particularly vulnerable to causes that suppress cognitive functions.

To date, few distinguished studies have been conducted that have shown that tooth extraction in rodents can induce functional and structural changes in brain regions involved in cognitive functions (20-22). Recent research conducted by Avivi-Arber et al. (20) demonstrated that tooth loss in mice is associated with widespread structural magnetic resonance imaging-defined structural changes in the somatosensory, motor, cognitive, and limbic regions of the brain. Another experimental study found that dental extraction in rats is associated with neuroplastic changes in the brain and that dental implant placement reverses extraction-induced changes (21).

Neuroplastic changes have also been demonstrated in animal and human studies in response to alterations in the environment induced by various factors, such as orthodontic tooth movement or nerve injury (23,24).

In the context of tooth extraction and cognitive function, another influential factor is age. Aged molar-less mice have shown a significantly reduced learning ability compared with that of age-matched control mice, whereas there was no difference between control and molar-less young adult mice (25).

In our study, we compared the MMSE scores before and after tooth extraction in the same patients. For each patient, we extracted a minimum of one and a maximum of five teeth, and we performed MMSE a second time 2 h after extraction. During this period, the local anesthetic effects of articaine were still ongoing, and no patients reported experiencing pain.

There were some limitations in this study. First, the follow-up duration was relatively short. Second, follow-up of the cognitive values could have been performed at 7 to 30 days after the extraction procedure.

In conclusion, the present study showed that cognitive performance was diminished in elderly patients after dental extraction. However, further studies are warranted to validate an association between dental extraction and cognitive decline. Further studies that assess oral microbiology, blood inflammation markers, patient-related factors, and the effect of tooth loss will be beneficial.

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Conflict of interest
No conflict of interest was declared by the authors.

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