

ERECTILE DYSFUNCTION

Effect of Edentulism and Oral Quality of Life on Sexual Functions in Men: A Cohort Prospective Study

Hasan Turgut, PhD,^{1,2} and Sedanur Turgut, PhD³

ABSTRACT

Introduction: Edentulism has a serious impact on quality of life (QoL), and changes in QoL can affect sexual functioning.

Aim: To assess the correlation between oral health-related quality of life (OHQoL) and sexual function in edentulous men.

Methods: A total of 148 men (18–70 years) with incomplete natural dentition completed the International Index of Erectile Function (IIEF) and Oral Health Impact Profile (OHIP-14) at 4 time points: before (T₀), during (T₁), 4 weeks after (T₂), and 1 year (T₃) after dental treatment. Kruskal–Wallis, Friedman, and Spearman's rank correlation tests were used for statistical analyses (significance at $P < .05$).

Results: IIEF total scores differed significantly between the time points ($P < .001$), with medians and interquartile ranges (IQR) of 46 (7), 42 (8), 49 (6), and 52 (5) at T₀, T₁, T₂, and T₃, respectively. The highest rate of sexual dysfunction was detected at T₁ (42.2%) and the lowest at T₃ (26.6%). IIEF domain scores also decreased at T₁ and increased at T₂ and T₃ compared with T₀ ($P < .05$). Median (IQR) OHIP-14 scores were 26.0 (8), 28.0 (8), 20.0 (6), and 18.0 (5), respectively ($P < .001$). OHIP score was significantly correlated with IIEF domain scores ($P < .05$) and there were strong negative correlations between OHIP and total IIEF scores at T₀ ($r = -0.737$), T₁ ($r = -0.802$), T₂ ($r = -0.831$), and T₃ ($r = -0.722$) ($P = <.001$ for all).

Main Outcome Measure: Changes and correlations in IIEF and OHIP-14 scores; SD and ED prevalences at T₀; T₁; T₂ and T₃ periods.

Clinical Implications: Sexual functions was significantly correlate with OHQoL; thus patients with ED should also be examined in terms of toothlessness.

Conclusion: OHQoL was significantly associated with sexual function in men. However, correcting the problem of edentulism improved OHQoL and sexual function, with the best results observed after 1-year follow-up. **H Turgut, S Turgut. Effect of Edentulism and Oral Quality of Life on Sexual Functions in Men: A Cohort Prospective Study. Sex Med 2021;9:100305.**

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Key Words: Edentulism; IIEF; Quality of Life; OHIP; Sexual Function

INTRODUCTION

Sexuality is a complex process affected by medical, social, psychological, economical, and other factors, and is closely related with quality of life.¹ The term sexual dysfunction (SD)

encompasses a range of problems related to sexual desire, arousal, orgasm, or pain.² The prevalence of SD ranges from 20% to 75% in men and increases with age.³ The National Institutes of Health described erectile dysfunction (ED) as the consistent or recurrent inability to attain and/or maintain adequate penile erection.⁴ ED often has a serious impact on quality of life, intimate relationships, and overall self-esteem.⁵ The International Index of Erectile Function (IIEF) is the gold standard self-report questionnaire used for evaluating erectile function in clinical trials for the approval of ED treatments.^{6,7} It has been reported that ED becomes more common with age and affects up to 1 in 3 men during their lives.⁸ Although the exact mechanism has not been well defined, there is clearly a link with mental health; ED can occur in the presence of psychological problems,

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and patients may experience psychological distress as a result of ED.⁵ A decline in sexual function has been associated with an overall decrease in quality of life, and several physiological causes of ED have also been identified.^{9,10} Epidemiological reports suggest a role of lifestyle factors, but there is insufficient evidence that treating the underlying risk factors and coexistent disorders with diet or stress management reduces ED.⁹

The World Health Organization described edentulism as a major public health issue worldwide that substantially influences both general and oral health status.¹¹ In accordance with various studies, tooth loss and edentulism can impact a person's general health in several ways.^{12,13} Individuals need a minimum number of natural teeth for sufficient dental function without prosthetic replacements, a state referred to as functional dentition.¹⁴ People can chew more foods when they have more than 20 teeth, and functional dentition is defined as the presence of 21 or more teeth.¹⁵ Previous research has shown that adults who are edentulous or have fewer natural teeth have lower quality diets.¹⁶ The treatment of edentulism is also disturbing and can affect patients' quality of life.

Oral health is a state of the oral tissues that contributes to overall physical, psychological, and social well-being by allowing individuals to eat, talk, and socialize without discomfort, pain, or distress.¹⁷ Oral health-related quality of life (OHQoL) is influenced by an individual's ability to chew effectively, speak clearly, and present an acceptably esthetic smile and facial appearance, without pain or halitosis.¹⁸ The Oral Health Impact Profile (OHIP) questionnaire is commonly used to determine the OHQoL and is available in different versions and translations.¹⁹ Edentulism has been shown to affect OHQoL and is increasing slowly at a rate of approximately 1% per year in most countries.²⁰

Toothlessness can result in body image issues, adverse psychological and social impacts, and poor nutrition, all of which are known to affect sexual performance. Demographic and socioeconomic factors are strongly associated with the prevalence of edentulism among adults.²¹ Moreover, these factors are also associated with the prevalence of SD in men. However, there is a lack of data in the literature about the link between toothlessness, oral health, and sexual function. Therefore, this study aimed to assess the relationship between OHQoL and SD in edentulous men before, during, and after (6 months and 1 year) dental treatment. The hypotheses tested in the present study were 1) there is a significant relationship between sexual function and OHQoL and 2) the prevalence of ED will decrease after completing dental treatments.

MATERIALS AND METHODS

Subjects

This prospective cohort study was carried out in the department of prosthodontics of Karadeniz Technical University and the urology department of Medicalpark Trabzon Hospital.

Institutional ethics board approval (no:2018/538) was obtained before initiation of this study and informed consent was obtained from all participants. Sample size calculation was performed using the G*Power 3.1.9.2 program. It was calculated in accordance with the previous article.²² Based on an alpha level of 0.05, beta error of 0.20, and effect size = 0.27, the total required sample size was calculated as 125. With a possible dropout rate of 20%, we determined that at least 148 patients.

A total of 148 men aged 18–70 years who had incomplete (presence of 1–20 natural teeth) or no natural dentition with no teeth replaced and were scheduled for dental treatment in the prosthodontics department participated in the study. Only the patients planned to make fixed prostheses (implant or natural teeth supported) were evaluated. The participants were selected from these edentulous patients who have not previously applied to the any clinic for SD treatment and have not taken any medication. Exclusion criteria were the presence of cardiovascular disease, alcoholism, smoking, or obesity, antidepressant drug use, and uncontrolled diabetes or hypertension. Data were collected using questionnaires administered in face-to-face interviews in a room separate from the clinic. All patients completed 2 different questionnaires for 4 time points: T₀, before prosthodontic treatment; T₁, during dental treatments (4 weeks after the dental treatments started); T₂, 4 weeks after, and T₃, 1 year after delivery of their new dentures and completion of the dental treatment. No additional treatment was applied to the patients for sexual functions before and after the dental procedures.

Questionnaires

International Index of Erectile Function

The Turkish version of the IIEF-15 was used to assess male sexual function. It consists of 15 items evaluating the domains of erectile function (questions 1–5 and 15), intercourse satisfaction (questions 6–8), orgasmic function (questions 9, 10), sexual desire (questions 11, 12), and overall satisfaction (questions 13, 14). Each response is rated on a scale of 0–5 or 1–5, with lower values corresponding to higher symptom burden. Patients were asked to consider which response was most applicable to them over the last 4 weeks while answering each question. For the 5 IIEF domains, maximum possible scores are 30 for erectile function, 10 for orgasmic function, sexual desire, and overall satisfaction and 15 for intercourse satisfaction, while minimum possible scores are 0 for intercourse satisfaction and orgasmic function, 1 for erectile function, and 2 for sexual desire and overall satisfaction.²² Total IIEF score ranges from 5 to 75, with higher results indicating better sexual function. Previous studies determined a cutoff score of 43 for SD.^{23,24} In addition, a cutoff score of 25 in the erectile function domain is optimal for differentiating men with and without ED. Based on this score, ED was classified into 4 subgroups: none (26–30), mild (22–25), mild to moderate (17–21), moderate (11–16), and severe (5–10).²⁵

Table 1. Sociodemographic characteristics of the study population

Variables	N	%
Age (year)		
18–35	52	35
35–45	32	22
45–70	64	43
Duration of marriage (year)		
<10	45	30
10–20	48	32
>20	55	38
Educational status		
Primary level or lower	71	48
High school	50	34
University	27	18
Employment status		
Unemployed	32	21
Employed	94	63
Retired	16	16
Perceived income level		
Poor	21	14
Moderate	127	86
Teeth loss		
Incomplete natural dentition	120	81
No natural dentition	28	19

Oral Health Impact Profile

The Turkish version of the Oral Health Impact Profile (OHIP-14) was used to evaluate OHQoL.²⁵ This questionnaire is a self-administered short-version of the original questionnaire and includes 14 questions in 7 domains: functional limitation, physical pain, psychological discomfort, physical disability, psychological disability, social disability, and handicap. The patients were asked how often they had experienced the impact of that factor in the last 4 weeks using a 5-point Likert-type scale (0: never, 1: hardly ever, 2: occasionally, 3: fairly often, and 4: very often). Domain scores range from 0 to 8 and are summed to obtain a total score between 0 and 56, with higher scores indicating lower OHQoL.¹⁸ The questionnaire was administered at T₀, T₁, T₂, and T₃ as described previously.

Statistical Analysis

All statistical analyses were made using IBM SPSS Statistics version 20.0 (IBM Corp., Armonk, NY). Normal distribution was analyzed by using Kolmogorov–Smirnov test and histogram. When the data were not normally distributed, the Wilcoxon signed rank test was applied to test for statistical significance differences.

Spearman's rank correlation test was used to analyze the relationship between two quantitative variables (nonnormal distribution for at least one variable). Data analyses were evaluated at a significance level of $P < .05$ and correlations were interpreted as very weak (negligible) ($r < 0.3$), weak ($0.3 \leq r < 0.5$),

moderate ($0.5 \leq r < 0.7$), strong ($0.7 \leq r < 0.9$), and very strong ($r \geq 0.9$).²⁶

RESULTS

Sociodemographic characteristics of the study population are presented in Table 1. The mean age was 40.4 ± 10.6 (min: 24; max: 67) years. Natural dentition was incomplete (fewer than 20 teeth) in 81% of the patients and the other 19% were fully edentulous (no natural teeth). The patients' median scores with interquartile ranges (IQR) and mean and standard deviation values for the IIEF domains (erectile function, orgasmic function, sexual desire, intercourse satisfaction, and overall satisfaction) are shown in Table 2. All domains showed statistically significant differences across the time points ($P < .001$). The distribution of patients with no ED and mild, mild to moderate, and moderate ED as per erectile function scores was 19%, 34.1%, 35.4%, and 11.6% at, respectively, T₀; 6.1%, 27.2%, 48.3%, and 18.4% at T₁; 25.2%, 40.2%, 30.3%, and 5.4% at T₂; and 38.8%, 39.4%, 17.7%, and 4.1% at T₃. None of the patients had severe ED.

The mean total scores of the IIEF for T₀, T₁, T₂, and T₃ were 46.5 ± 5.1 (range, 34–60); 41.6 ± 4.7 (range, 29–52), 49.0 ± 5.1 (range, 34–62), and 51.1 ± 4.3 (range, 38–64), respectively (Table 3). Total IIEF scores also differed significantly across the time points ($P < .001$). Median and IQR values for total IIEF score at T₀, T₁, T₂, and T₃ were 46.0 (7), 42.0 (8), 49 (6), and 52.0 (5), respectively. Based on the total IIEF score cutoff of ≤ 43 , 38.4% of the men had SD at T₀, 42.2% at T₁, 30.3% at T₂, and 26.6% at T₃. All IIEF domain scores and IIEF total score decreased at T₁ compared with T₀ and followed by significant increases at T₂ and T₃, representing improved sexual function.

Mean OHIP scores at T₀, T₁, T₂, and T₃ were 25.7 ± 3.7 (range 11–41), 27.7 ± 4.4 (range 12–44), 19.1 ± 3.6 (range 8–31), and 17.3 ± 3.9 (range 7–31) points (Table 3). OHIP-14 scores also differed significantly across the time points ($P < .001$), with median and IQR values of 26.0 (8), 28.0 (8), 20.0 (6), 18.0 (5), respectively. OHIP-14 score increased significantly during dental treatments (T₁), representing a decline in OHQoL. However, OHIP scores decreased significantly at T₂ and T₃ ($P < .001$).

Correlations between total OHIP scores and IIEF total and domain scores are presented in Table 4. The analysis showed that OHIP score correlated with all IIEF domains ($P < .05$). For total IIEF and OHIP scores, negative correlations were detected at T₀ ($r = -0.737$, $P < .001$), T₁ ($r = -0.802$, $P < .001$), T₂ ($r = -0.831$, $P < .001$), and T₃ ($r = -0.722$, $P < .001$).

DISCUSSION

This prospective clinical study aimed to determine the impact of toothlessness and oral quality of life on sexual function in

Table 2. International Index of Erectile Function domain scores before (T₀), during (T₁), 4 weeks after (T₂), and 1 year (T₃) after dental treatment

IIEF domains	T ₀ (mean ± SD) median [IQR]	T ₁ (mean ± SD); median [IQR]	T ₂ (mean ± SD); median [IQR]	T ₃ (mean ± SD); median [IQR]
Erectile function	(21.8 ± 3.6); 22.0 [5] ^a	(20.3 ± 3.4); 20.0 [5] ^b	(22.8 ± 4.2); 22.0 [5] ^c	(25.2 ± 3.4); 25.0 [5] ^d
Orgasmic function	(6.4 ± 1.6); 6.0 [1] ^a	(5.7 ± 1.7); 6.0 [2] ^b	(6.8 ± 1.7); 7.0 [2] ^c	(6.9 ± 2.0); 7.0 [1] ^d
Sexual desire	(5.3 ± 0.7); 5.0 [1] ^a	(5.1 ± 1.9); 5.0 [2] ^b	(5.8 ± 1.6); 6.0 [2] ^c	(5.9 ± 1.9); 6.0 [1] ^d
Sexual satisfaction	(7.2 ± 0.8); 7.0 [2] ^a	(6.2 ± 1.7); 6.0 [2] ^b	(8.1 ± 2.1); 8.0 [2] ^c	(7.4 ± 1.7); 7.0 [2] ^d
General satisfaction	(5.7 ± 1.1); 5.0 [2] ^a	(4.8 ± 0.6); 5.0 [1] ^b	(6.0 ± 1.2); 6.0 [2] ^c	(6.1 ± 1.8); 6.0 [2] ^d

Different superscript letters shows the significant median of differences between the columns (T₀; T₁; T₂; T₃) horizontally. The significance level is $P < .05$.

Table 3. Total Oral Health Impact Profile (OHIP-14) and International Index of Erectile Function (IIEF) total scores before (T₀), during (T₁), 4 weeks after (T₂), and 1 year (T₃) after dental treatment

OHIP-14 domains	T ₀ (mean ± SD) median [IQR]	T ₁ (mean ± SD) median [IQR]	T ₂ (mean ± SD) median [IQR]	T ₃ (mean ± SD) median [IQR]
OHIP-14	(25.7 ± 3.7); 26.0 [8] ^a	(27.7 ± 4.4); 28.0 [8] ^b	(19.1 ± 3.6); 20.0 [6] ^c	(17.3 ± 3.9); 18.0 [5] ^d
IEFF	(46.5 ± 5.1); 46.0 [7] ^a	(41.6 ± 4.7); 42.0 [8] ^b	(49.0 ± 5.1); 49.0 [6] ^c	(51.1 ± 4.3); 52.0 [5] ^d

Different superscript letters shows the significant differences between the columns (T₀; T₁; T₂; T₃) horizontally. The significance level is $P < .05$.

Table 4. Correlation between OHIP-14 and IIEF domain and total scores before (T₀), during (T₁), 4 weeks after (T₂), and 1 year (T₃) after dental treatment

	T ₀		T ₁		T ₂		T ₃	
	r	P	r	P	r	P	r	P
OHIP								
r								
P								
IIEF								
Total score	0.737	<.001	0.802	<.001	0.831	<.001	0.722	<.001
Erectile function	0.785	<.001	0.856	<.001	0.802	<.001	0.896	<.001
Orgasmic function	0.516	.018	0.469	<.001	0.612	<.001	0.626	<.001
Sexual desire	0.462	.021	0.646	<.001	0.521	.002	0.704	<.001
Sexual satisfaction	0.682	.011	0.490	<.001	0.701	<.001	0.694	<.001
General satisfaction	0.752	<.001	0.668	<.001	0.632	<.001	0.744	<.001

P: The value of statistical significance; r: correlation coefficient. The significance level is $P < .05$. IIEF = International Index of Erectile Function; OHIP-14 = Oral Health Impact Profile.

men. Our results demonstrated significant correlations between OHIP scores and IIEF total and domain scores, thereby supporting the first study hypothesis that sexual function and OHQoL are associated. The patients' erectile function, orgasmic function, sexual desire, intercourse satisfaction, and overall satisfaction improved as their OHQoL improved in the present study.

Edentulism can directly cause functional, physical, psychological, and social disability, as well as a diminished sense of well-being,²⁷ all of which can impact patients' general health in various ways. Lifestyle modifications such as increased physical activity, adequate calorie intake, and healthy nutrition have been associated with improvement in erectile function in the general male population.²⁸ Some researchers have reported a strong positive correlation between sexual function and health-related quality of life.^{10,22–30} Desire and satisfaction involve not only physical sexual function but also an individual's social and emotional sexual experiences. Therefore, interpersonal, psychological, social, and cultural factors should be addressed as well when investigating possible reasons for ED.²⁸

Previous studies showed that men with functional dentition (21 or more natural teeth) ate more servings of fruit and vegetables and had higher α/β -carotene intake compared to edentulous men.^{31–33} Denture wearers may also have difficulty chewing, resulting in a poor diet.³¹ Diet quality, food intake, and serum nutrient levels are generally lower among denture wearers than patients with complete or partial natural dentition.^{15,32} Only adults who have well-fitting dentures exhibited similar nutrient intake and dietary quality to those with natural teeth.³³ Esposito et al³⁴ evaluated the effect of diet on ED. Their randomized study demonstrated lower risk of ED when the individuals consumed a diet rich in vegetables, fruit, and whole grains.

In accordance with the results of our study, the lowest IIEF scores and highest OHIP scores were found at T₁, which was during dental treatment. Undergoing dental treatments for incomplete dentition can cause oral discomfort and pain, thereby reducing OHQoL.^{13,27} The decrease in IIEF scores during treatment may be related to previously reported observations that dental rehabilitation can have a tremendous impact on patients. However, after completion of treatment and delivery of the new dentition, OHIP scores decreased and IIEF scores increased. In our image-conscious world, dentures restore a sense of normality and enhance the patient's ability to interact socially. It is reported that patients' adaptation to new dentures can last up to a year.³⁵ Similarly, the best scores for sexual function and OHQoL were observed 1 year after completing dental treatment and showed a significant improvement over pretreatment levels.

In accordance with total IIEF scores in the present study, SD was detected in 38.4% at T₀, 42.2% for T₁, 30.3% at T₂, and 26.6% at T₃. The highest prevalence of ED was seen at T₁ (48.3% mild to moderate and 18.4% moderate) whereas the lowest was seen at T₃ (17% mild to moderate and 4.1%

moderate). The ED prevalence was lower at T_2 and T_3 than at T_0 , supporting the second study hypothesis that the prevalence of ED would decrease after completion of dental treatments. Our results point to a strong relationship between lower OHQoL and higher prevalence of ED. Among healthy men, ED has been reported at rates of 20–80%.³⁶ In fact, the results of the present study were not surprising, considering the increased social, psychological, and esthetic problems men face when coping with mastication and speech impairments result from the chronic nature of edentulism, and these factors can also affect SD. Lifestyle and diet are recognized as the main factors affecting the production of vascular NO and erectile function.²⁷ Lifestyle habits that decrease low-grade inflammation may have a role in reducing the burden of SD.²⁹ Moreover, emotional stress and depression may cause ED without any vascular dysfunction.

Researchers have also evaluated the effect of infectious periodontitis on ED. This oral disease causes the loss of both attachment of the periodontal ligament and the bony support of the tooth, and is generally responsible for tooth loss. Authors have reported a strong relationship between ED and periodontitis, noting that this oral disease may induce systemic vascular diseases.^{36–39} Zadik et al⁴⁰ showed that chronic periodontitis was more common among men with ED and suggested a relationship between the two disorders. Similarly, Sharma et al⁴¹ reported the highest chronic periodontitis prevalence among patients with ED. In the present study, the patients were evaluated before and after periodontal treatment to rule out the possible effects of periodontitis on ED.

Although the studies assessing the role of lifestyle changes in ED are limited by their small sample sizes, the European Association of Urology recently stated that “lifestyle changes and risk factor modification must precede or accompany ED treatment”, with a level 1b, grade A evidence rating. Therefore, promoting healthful living or primary prevention can lessen the burden of non-communicable diseases such as SD.²⁷ Although SD and poor oral health are not life-threatening conditions, they still have an impact on individual well-being. Heydecke et al⁴² have also evaluated the impact of prostheses on social and sexual activities in edentulous adults for 2 months after treatment. The authors also reported that edentulism has a negative impact on social and sexual life. The analysis of the present study showed moderate to strong correlations between OHQoL and sexual function in men. The results suggest that improving oral health by eliminating patients’ dental deficiencies may have positive effects on quality of life and sexual function in men and reduce the prevalence of ED. Restoration of the esthetic, oral function, and phonation of the men in our study due to their new dentures, and the subsequent increase in their quality of life may explain the improvement in sexual function. Undoubtedly, this study not to aim to cure the SD in men; but to reveal the frequency of SD in edentulous patients and also to see the effect of improving the oral health with prosthesis on SD in men. It’s known that risk factor categories associated with SD include

general health status of the individual, the presence of diabetes mellitus, cardiovascular problems, obesity, psychiatric/psychological disorders, and sociodemographic conditions. Several cross-sectional and longitudinal studies showed these associations. So, the patients meeting any of these criteria were excluded to prevent the risk factors’ effect on the results. This study reveals that edentulousness, which affects the quality of life of individuals, may also be a criterion that will affect SD. Further research will be beneficial to elucidate the mechanism underlying these findings.

A limitation of this study was that all of the included men were from the same region. A similar analysis can be conducted with large samples from different regions and populations. A *quasi-experimental design method* was used without a control group in this study. It was a single-arm intervention and each patient serve as his own control. In addition, the sample of the study included only patients who presented to the dental hospital for treatment. The patients included in the study were edentulous for at least 4 weeks. However, some patients may have longer periods of toothlessness before applying, and these durations of edentulism may also have effect on the results. Further studies should also evaluate SD and its determining factors in men who do not present to the hospital but need prosthodontic treatment.

CONCLUSIONS

Within the limitations of the present study, the following conclusions were reached:

1. Sexual function and OHQoL were significantly correlated in men.
2. OHIP scores increased significantly during dental treatments (T_1) and decreased after completion of the dental treatments (T_2 and T_3) compared to before treatment (T_0).
3. Total IIEF scores differed significantly between T_0 , T_1 , T_2 , and T_3 . IIEF domain and total scores decreased at T_1 , then increased at T_2 and T_3 , showing improved sexual function.
4. ED prevalence was highest at T_1 , during dental treatment, and lowest at T_3 , 1 year after completion of dental treatment.

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