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Vision Total Knee Replacement System Mid-term Survival and Radiological Results

Vision Diz Protezi Orta Dönem Sağkalımı ve Radyolojik Sonuçları

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Abstract

Objective: To evaluate and assess radiographic findings, revision causes, and survival rate of a total knee replacement system.

Methods: We retrospectively evaluated 359 total knee arthroplasties performed by the same surgeon at a single center between January 2016 and December 2023. Revisions, reoperations, complications, radiographic, and patient data were thoroughly evaluated to address any problems with patients, surgical procedures, and implants.

Results: Three revisions were made for two deep infections and one patient with arthrofibrosis. Two periprosthetic fractures occurred, which were treated without revision surgery. Five-year survival rate was 99.2% for any reason. Radiolucent lines that were found in 2.8% patients did not progress to loosening. The total number of patients identified with abnormal findings for both femoral and tibial components was 44 (12.2%). There was no aseptic loosening or implant-related complication.

Conclusion: Vision total knee system has a 99.2% survival rate for any reason at 5 years. When complications and revisions are evaluated, it is a safe option for total knee arthroplasty.

Keywords: Total knee, radiologic, survival, mid-term, aseptic, septic

Öz

Amaç: Total diz protezi sisteminin radyografik bulgularını ve revizyon nedenlerini değerlendirmek ve sağkalım oranını belirlemek amaçlanmıştır.

Yöntem: Ocak 2016 ile Aralık 2023 arasında tek bir merkezde aynı cerrah tarafından gerçekleştirilen 359 total diz artroplastisi geriye dönük olarak değerlendirildi. Revizyonlar, yeniden operasyonlar, komplikasyonlar, radyografik veriler ve hasta verileri kapsamlı bir şekilde değerlendirilerek; hastalar, ameliyatlar ve implantlarla ilgili problemler değerlendirilmiştir.

Bulgular: Üç revizyon ameliyatının ikisi derin enfeksiyon için ve biri artrofibrozis için yapılmıştı. İki periprostetik kırık meydana geldi ve revizyon cerrahisi olmadan tedavi edildi. Tüm nedenler için beş yıllık sağkalım oranı %99,2 idi. Radyolüsen hatlar hastaların %2,8'sinde görüldü ve implant gevşemesine ilerlemedi. Femoral ve tibial bileşenler için anormal bulgularla tespit edilen toplam hasta sayısı 44'tür (%12,2). Aseptik gevşeme veya implantla ilgili komplikasyon izlenmedi.

Sonuç: Vision total diz sistemi, 5 yıl boyunca herhangi bir neden için %99,2 sağkalım oranına sahiptir. Komplikasyonlar ve revizyonlar değerlendirildiğinde, total diz artroplastisi için güvenli bir seçenektir.

Anahtar Kelimeler: Total diz, radyolojik, sağkalım, orta dönem, aseptik, septik

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Introduction

Total knee replacement has become the standard method for relieving pain and disability in patients with advanced knee arthritis. Aging populations need an increasing number of total replacement surgeries each year. The success of a total knee replacement procedure depends on relieving pain and reducing disability. However, time is a multiplying factor, and knee implants must last for many years. The survival rate of total knee arthroplasty for all causes is 90-95% for 10 years and 80-90% for 15 years[1,2]. The most frequent revision causes are septic loosening for 36-58% and aseptic loosening (mechanical or bone implant interface problems) for 22-42%[2,3]. Apart from these frequent reasons, polyethylene wear, knee instability, periprosthetic fracture, osteolysis, and malalignment are other factors that play a role in revisions[2-4]. Long-term follow-up studies have shown that reduced survival rates and polyethylene wear or osteolysis dominate the causes of revision surgeries after 10 years[5]. Postoperative follow-up controls are important to address instability, osteolysis, loosening, and infection at an early stage. The purpose of this study is to assess mid-term outcomes of primary knee replacement procedures performed at a single center by the same surgeon using the same replacement system.

Materials and Methods

The earliest recorded patients whose digital medical records could be accessed at the Kahramanmaraş Necip Fazıl City Hospital (January 2016) had been scanned until December 2023. Approval for the study was obtained from Kahramanmaraş Sütçü İmam University Clinical Research Ethics Committee (decision no: 04, date: 18.06.2021). Only patients who had undergone surgery with a single brand of knee prosthesis (Vision Total Knee System, Zimed, Gaziantep, Türkiye) were included in the study, and no other exclusion criteria were applied. Two hundred ninety-eight consecutive patients with 359 total knee replacements were retrospectively included in the study. The patients' medical records were examined to analyze: demographic data, American Society of Anesthesiologists (ASA) surgical risk score, type of prosthesis used, follow-up duration, degree of knee arthrosis, alignment of the prosthesis, complications observed during and after surgery, whether revision was necessary, causes for revision surgery, radiolucent areas indicating bone osteolysis, and prosthesis subsidence.

The follow-up period for patients was recorded as the time until the last images obtained post-surgery. Postoperative complications included deep infections, deep vein thrombosis, pulmonary embolism, iatrogenic fracture, tibiofemoral dislocation, neural deficit, wound complications, periprosthetic fracture, ligament damage, (around the knee tendons), patellar instability, polyethylene fracture, and bleeding complications. The medical records of the patients were examined for side effects such as metal allergy and residual risks. The degree of knee arthrosis was assessed according to the Kellgren-Lawrence classification (Figure 1). Standard criteria accepted in the literature and a scoring system [The Knee Society Roentgenographic Evaluation and Scoring System, (KSRESS)] were used when evaluating knee radiographs[6,7].

The alignment of the coronal plane of the prosthesis was performed according to 5 degrees of valgus in men and 7 degrees of valgus in women. The sagittal plane evaluation was conducted with the knee flexed at 90 degrees and with a tibial slope angle of 5 degrees. Deviations of 3 degrees and above in these angles were considered abnormal. The position of the femoral component in the sagittal plane was evaluated according to the method suggested by Gujarathi et al.[8] regarding femoral notching (excessive femoral resection), accepted in the literature. A cement thickness of less than two millimeters in the femoral and tibial components, as well as an overflow of the prosthetic components under two millimeters (large size or decentralized fixation), were considered normal. Due to the limited number of patients who had knee computed tomography imaging, rotational measurements were not included in the study. When assessing prosthesis subsidence and polyethylene wear, patients with a follow-up of at least 48 months had these aspects examined, and subsidence greater than two millimeters in the femoral or tibial components or more than one millimeter of polyethylene wear was considered significant.

Statistical Analysis

Data were analyzed with the IBM SPSS version 25 program and $p<0.05$ was accepted as the significance level (IBM SPSS Inc., NY/USA). Paired t-tests were compared to previous literature results to detect radiological and clinical outcomes, complications, and safety profiles. Kaplan-Meier survivorship analysis was used for the endpoint of septic loosening, aseptic loosening, or revision for any cause.

Results

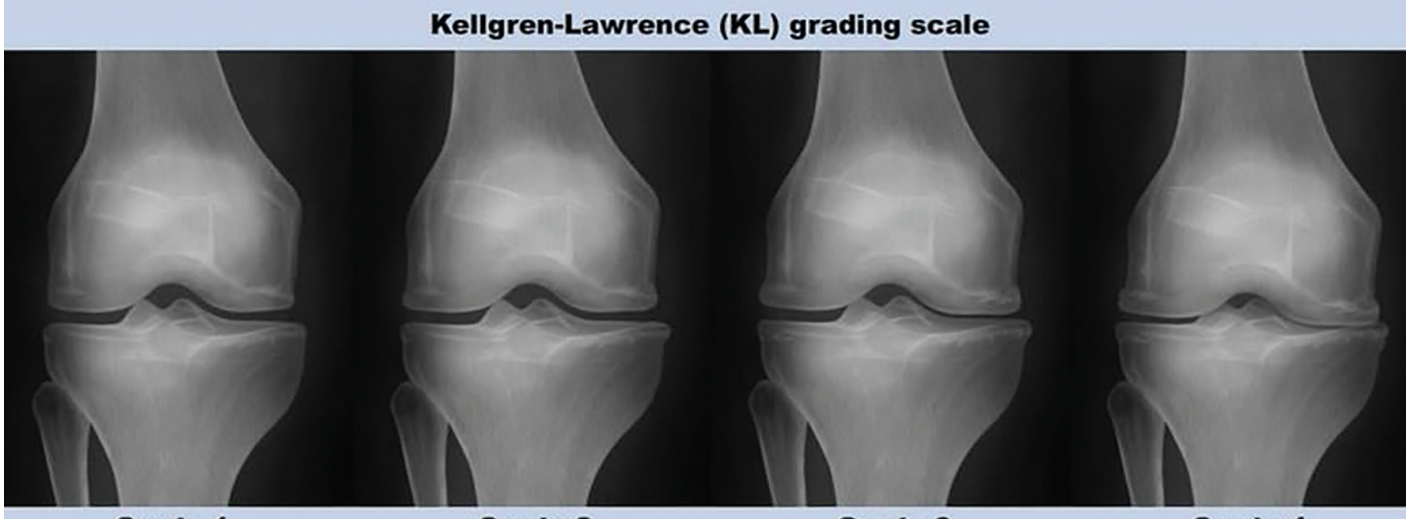
The average age of the 359 patients forming the study group was 66.1 (min: 46 to max: 90). Demographic data of

the patients, arthritis grade, follow-up time, and prosthesis type are presented in Table 1. When evaluating the follow-up durations, the average period for 48 knee prostheses was observed to be 6.2 months. In this group with a short follow-up period, no complications, metal allergies, or need for revision surgery were observed. The average follow-up period for the remaining 311 knee prostheses was 65.2 months (min: 24 to max: 112 months).

In the evaluation of the tibial component alignment, there were 25 patients (6.9%) identified with a varus of 3 degrees or more, while 14 patients (3.9%) were observed with excessive tibial slope. None of the patients had a tibial cement thickness greater than 2 mm or a tibial component eccentricity greater than 2 mm. The number of patients identified outside normal limits specifically for the tibial component was 39 (10.8%). In the evaluation of the femoral component alignment in the coronal plane, two patients had abnormal findings, whereas in the sagittal plane assessment, two patients with grade 2 femoral notching, and one patient with minimal notching were identified. Cumulatively, the total number of patients identified with abnormal findings for both femoral and tibial components was 44 (12.2%). These findings are summarized in Table 2.

A total of 269 patients with a follow-up period of 4 years or longer were examined for polyethylene wear and subsidence. No polyethylene wear or subsidence was detected in measurements made with plain radiographs. In the evaluation of radiolucent areas, non-progressive radiolucent areas were observed in the medial tibial component in six patients and in the anterior femoral component in four patients (in 10 patients, representing 2.8%). No progression or loosening was observed during the follow-up of these patients.

When evaluating complications, it was observed that two patients developed traumatic periprosthetic fractures during follow-up, but there was no need for prosthesis revision (Figure 2). Late-stage prosthetic infection was observed in both patients, and revision was performed due to infection in the fourth year (Figure 3). One patient underwent the revision knee prosthesis in the fourth month because of an inability to achieve knee extension caused by arthrofibrosis (Figure 4). While 5 patients (1.4%) had complications, 3 patients (0.8%) underwent revision surgery. There were no cases of tibiofemoral dislocation, patellar instability, tendon rupture, polyethylene fracture, or secondary surgeries due to vascular or nerve damage. Deep vein thrombosis was



CLASSIFICATION	Normal	Doubtful	Mild	Moderate	Severe
DESCRIPTION	No features of OA	Minute osteophyte: doubtful significance	Definite osteophyte: normal joint space	Moderate joint space reduction	Joint space greatly reduced: subchondral sclerosis

Figure 1. Kellgren-Lawrence arthritis grading scale

observed in 12 patients (3.3%), and deep vein thrombosis with pulmonary embolism was observed in 4 patients (1.2%). Complications are summarized in Table 3.

Survival rate for all-cause at 5-year follow-up is 99.2%. The survival rate for septic failure at 5-year follow-up is 99.5%. The Kaplan-Meier survivorship analysis results are shown in Table 4.

Discussion

After total knee replacement, asymptomatic patients should undergo an X-ray once every year; yet there are no guidelines for follow-up radiographs. This lack of standardization in follow-up care might lead to missed opportunities for early detection of complications, such as instability or joint deterioration. The KSRESS can be a useful tool for monitoring patient progression[7]. Although radiolucent lines are not directly associated with implant loosening[9], progressive radiolucent lines are commonly a sign of aseptic loosening[10]. Compared with neutral alignment, malalignment is also a contributing factor to shorter survival rates[11]. A review of twelve studies showed that when a manual surgical technique is applied and 3 degrees of deviation from the mechanical axis is targeted, 26% of patients could be in the outlier group[12]. Another study comparing robotic surgery to conventional surgery showed 10.9% mechanical axis outliers in conventional surgery group[13]. Our 12.2% malalignment finding is comparable to the literature. In our series, we did not find any progressive radiolucent lines, and malalignment was not associated with any revisions.

The most common reasons for knee replacement revision and re-revision are aseptic loosening, infection, and instability[2]. The 10-year survival rate of total knee arthroplasty for any reason is more than 90%[1]. Also, high crosslinked polyethylene liners have better wear properties, and when used they have shown better survival rates for any reason for revision[14]. Over the past years, the percentage of revision surgeries due to polyethylene wear has declined, and the aseptic loosening percentage has become second after infection, the most common cause, likely due to improved polyethylene materials and surgical techniques[4]. Periprosthetic fractures are minor causes for revision (1.1%) and are associated with implant-related, patient-related, and surgery-related factors[15]. We had two periprosthetic fractures caused by a fall at home, and a revision procedure was not necessary. We found a 99.2% survival rate at 5 years with three revisions: one for arthrofibrosis and two for deep infection. Our result is comparable to mid-term 92.9-99.3% survival rates of cemented knee arthroplasty[16-18].

Table 1. Demographic data and various findings of study group

Age (mean)	**66.1 years**		
Sex	Male 29.6%		Female 70.4%
Side	Left 32.2%	Right 50.8%	Bilateral 17%
ASA score	ASA 1 - ASA 2 42% ASA 3 57% ASA 4 1%		
Kellgren-Lawrence grading	Normal - Grade 1 - Grade 2 13% Grade 3 34% Grade 4 53%		
Prosthesis type	P/S 81.6%		C/R 18.4%
Follow-up months	<24 13.4%	>48 48.8%	>96 12.1%

ASA: American Society of Anesthesiologists

Table 2. Alignment and positional complications

n=359	Tibial component	Femoral component
Sagittal	3.9% slope	None
Coronal	6.9% varus	0.5%
Axial	Not identified	Not identified
Translation, femoral notching	None	0.8% notching
Cement thickness	<2 mm	<2 mm
Cumulative	10.8%	1.3%

Table 3. Complications

n=359	
Prostetic infection*	2 (0.5%)
Periprostetic fracture	2 (0.5%)
Arthrofibrosis*	1 (0.3%)
Deep vein thrombosis	12 (3.3%)
DVT with pulmonary embolism	4 (1.2%)
Cumulative	17 (4.6%)

DVT: Deep vein thrombosis, *: Three patients had revision arthoplasty

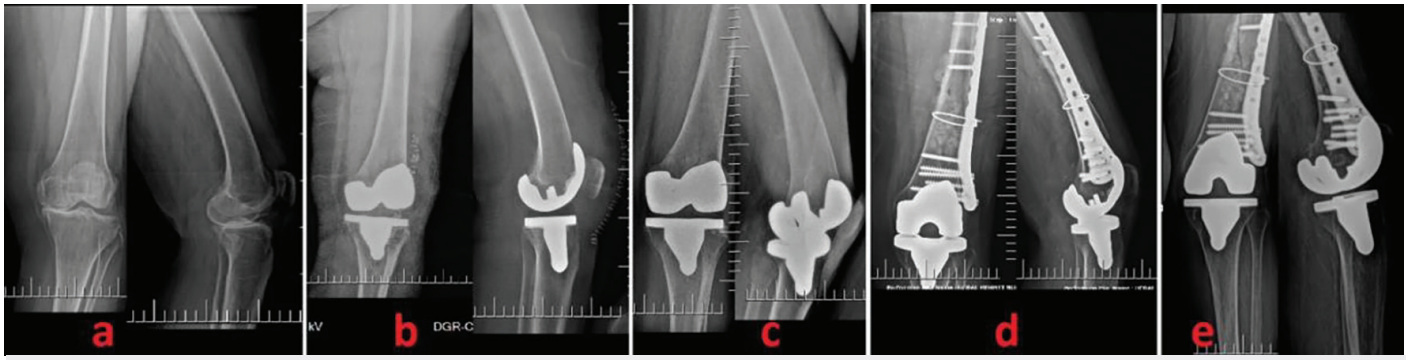


Figure 2. a) Eighty year old women with grade 4 arthritis b) Postoperative X-rays c) 46 months follow-up d) At 56 month periprosthetic fracture occurred and treated accordingly e) 89 month follow-up

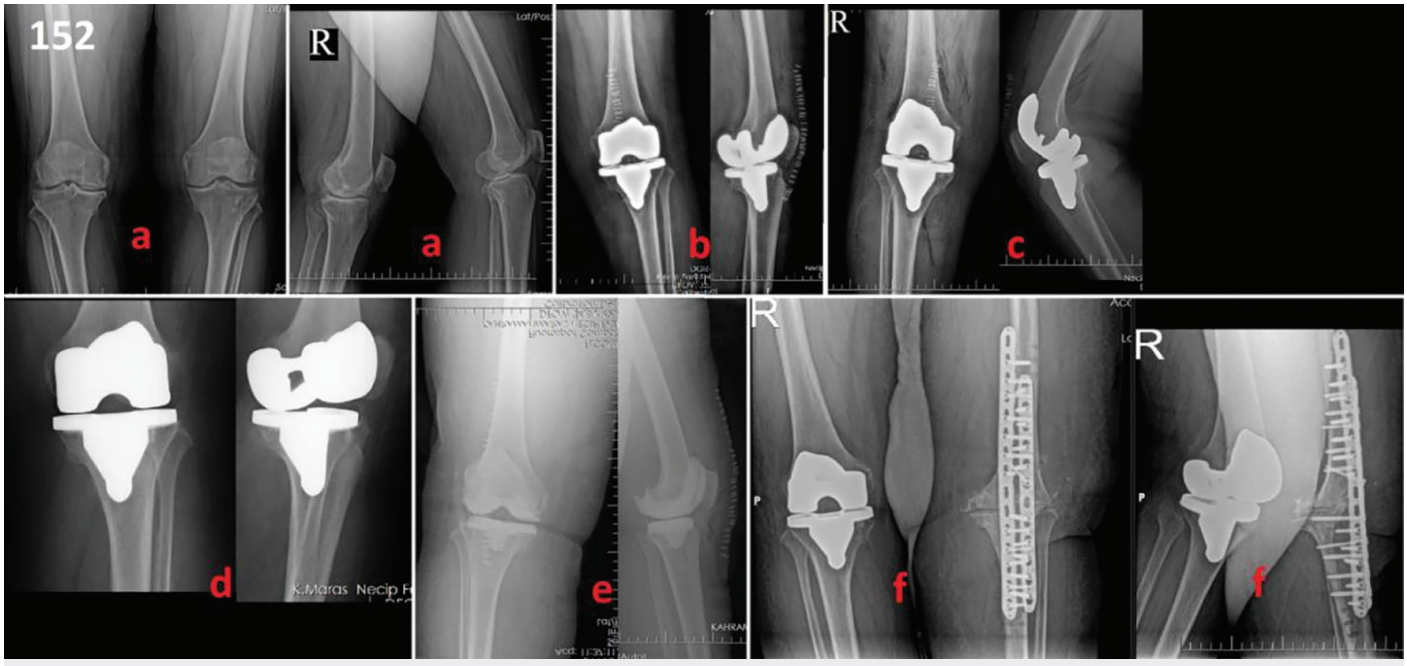


Figure 3. a) Seventy year old women with grade 3 arthritis b,c) One stage bilateral arthroplasty has been made d) At 52 months postoperatively septic loosening occurred e) Two staged treatment started f) Arthrodesis surgery with two plates has been made at 63 month

Table 4. Five year survivorship analysis of vision total knee system

Time period (year)	At risk	Lost to follow-up	Revised or failed	Survival probability estimate	95% confidence interval	
					Lower limit	Upper limit
First	359	19	1	1.000	0.971	0.999
Second	353	29	0	0.995	0.954	0.998
Third	311	43	0	0.995	0.942	0.996
Fourth	269	75	2	0.981	0.927	0.995
Fifth	194	46	0	0.981	0.911	0.995
The number of knees included at the beginning of the study=359						

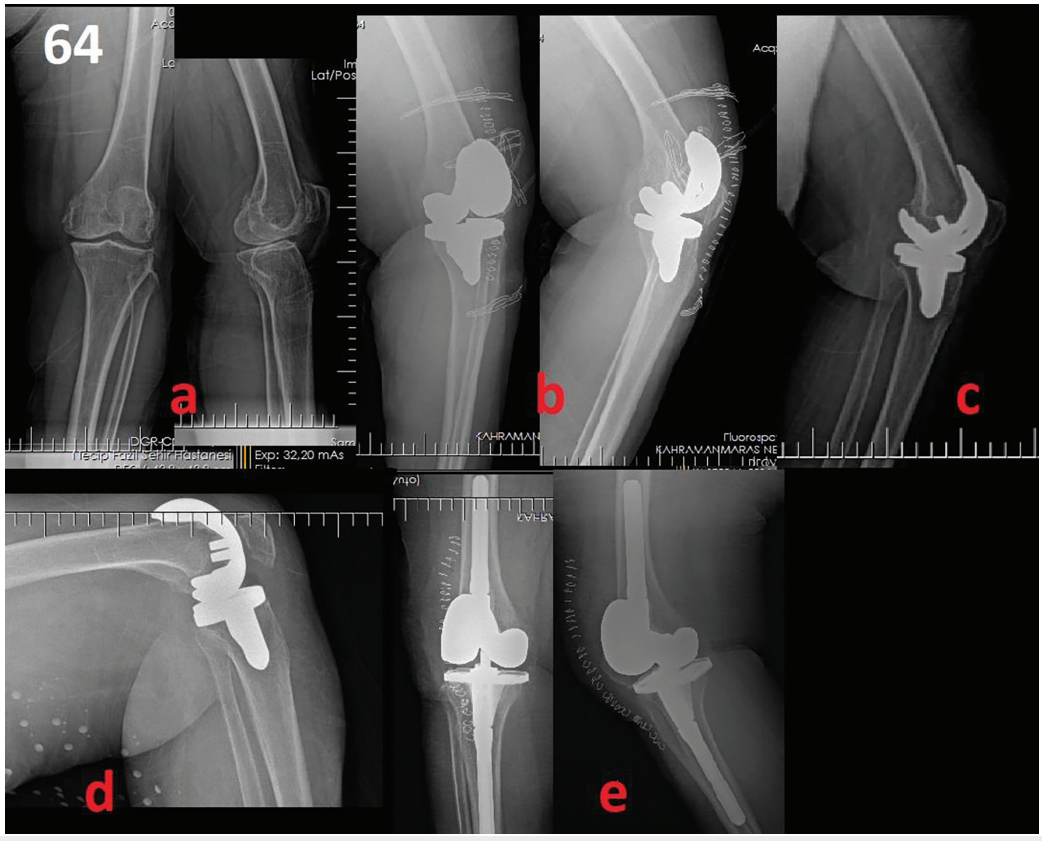


Figure 4. a) Fifty-five year old man with grade 2 arthritis b) Postoperative X-rays c) Extension loss of 40 degrees d) Flexion deformity can be seen at fifth month e) One stage revision has been made

Study Limitations

Although a thorough investigation of the patients' medical data has been conducted, the retrospective nature of our study, which lacks clinical scores and randomization, may limit the strength of our conclusions.

Conclusion

Mid-term results of a particular total knee replacement system showed satisfactory radiological outcomes, no implant-related complications, and a low revision rate. In light of these positive outcomes, it is evident that the Vision Total Knee Replacement System is a safe and effective treatment option for patients suffering from degenerative joint diseases.

Ethics

Ethics Committee Approval: Approval for the study was obtained from Kahramanmaraş Sütçü İmam University Clinical Research Ethics Committee (decision no: 04, date: 18.06.2021).

Informed Consent: Retrospective study.

Footnotes

Authorship Contributions

Surgical and Medical Practices: M.N.Ü., Concept: H.T.U., M.N.Ü., Design: H.T.U., M.N.Ü., Data Collection or Processing: H.T.U., Analysis or Interpretation: H.T.U., M.N.Ü., Literature Search: H.T.U., M.N.Ü., Writing: H.T.U., M.N.Ü.

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

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