



PLANTAR CUTANEOUS SENSATION AND POSTURAL CONTROL IN NSCLBP: A CASE-CONTROL STUDY

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ABSTRACT

Objective: Postural control deficits and reduced physical performance are well documented in non-specific chronic low back pain (NSCLBP); however, it remains uncertain whether impairment of plantar cutaneous sensation contributes meaningfully to these disturbances. This study, therefore, aimed to investigate the association between plantar sensory function, postural balance, and functional performance in patients with NSCLBP relative to healthy controls.

Materials and Methods: A cross-sectional case-control design was employed, and data were collected at a single center. The sample comprised 30 individuals diagnosed with NSCLBP and 30 age- and sex-matched healthy volunteers. Plantar light touch-pressure (Semmes-Weinstein monofilaments), vibration (128 Hz diapason), and two-point discrimination (esthesiometer) thresholds were measured at standardized plantar regions. Static balance (one-leg stance test with eyes-open and eyes-closed), dynamic balance (Y balance test in the anterior, posteromedial, and posterolateral directions), and physical performance [timed up and go test (TUG)] were assessed. Pain (10-point visual analog scale), disability (Oswestry disability index), and depression (Beck depression inventory) were recorded. Between-group comparisons and correlations between plantar sensation measures and balance and functional outcomes were analyzed.

Results: Compared with healthy controls, NSCLBP patients demonstrated poorer plantar sensory function, reduced static and dynamic balance performance, and longer TUG durations (all $p < 0.05$). In the NSCLBP group, plantar sensory measures were significantly correlated with postural balance and physical performance on the dominant side ($p < 0.05$).

Conclusion: Decreased plantar cutaneous sensation was significantly associated with impaired postural balance and functional performance in NSCLBP. Plantar sensory testing may therefore represent an additional clinical parameter in the evaluation of these patients and help guide individualized conservative rehabilitation strategies.

Keywords: Non-specific chronic low back pain, plantar foot sensation, postural balance, physical performance, Y balance test

INTRODUCTION

Dynamic and static balance of the spinal column are maintained through complex interactions between proprioceptive input and the musculoligamentous system^(1,2). From a functional perspective, body stability during quiet stance and voluntary movement is a key criterion of balance and is essential for efficient gait and daily activities⁽³⁾. Plantar cutaneous mechanoreceptors provide critical contact with the environment, particularly during weight-bearing and locomotor tasks such as walking⁽⁴⁾. Perception of alterations in light touch, pressure, and vibration via these mechanoreceptors contributes to the fine regulation of postural balance^(5,6). Accordingly, decreased plantar foot sensation may adversely affect locomotor stability⁽⁵⁻⁸⁾. Meyer et al.⁽⁶⁾ demonstrated that proprioceptive deficits caused by

reduced plantar sensation can impair postural control and deteriorate balance even in healthy individuals.

Insufficient proprioceptive information arising from the lumbopelvic and lower-limb region has been proposed as one of the mechanisms underlying altered trunk muscle activation and difficulties in postural control and repositioning of the body in patients with non-specific chronic low back pain (NSCLBP)⁽⁹⁾. Reduced physical capacity and curtailed daily activity participation consistently co-occur with postural instability in chronic low back pain, a pattern corroborated by clinical evidence from several independent studies^(1,2,10).

Despite this body of evidence, the specific contribution of plantar foot sensation to postural balance and physical performance in NSCLBP has not been systematically characterized. To address this gap, the present study was designed to examine

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the interrelationships among plantar sensory function, static and dynamic postural control, and functional performance, contrasting NSCLBP patients with age- and sex-matched healthy individuals. The central hypothesis held that NSCLBP patients would exhibit concurrent impairments spanning plantar cutaneous sensitivity, static and dynamic postural stability, and physical performance each dimension more compromised than in matched healthy controls.

MATERIALS AND METHODS

Study Design and Ethical Approval

All assessments were carried out at a single clinical site Üsküdar University (İstanbul, Türkiye) within the framework of a cross-sectional case-control design. The study protocol was reviewed and approved by the Local Ethics Committee of Üsküdar University (approval no: 61351342-/2019-461, date: 24.10.2019), with all procedures carried out in full accordance with the ethical standards set forth in the Declaration of Helsinki. Written informed consent was secured from every participant following comprehensive disclosure of the study protocol and procedures, as required prior to formal enrolment.

Participants

Thirty NSCLBP patients and 30 age- and sex-matched healthy controls were recruited for participation in this study. Patients had a history of low back pain exceeding 3 months. All participants were between 18-50 years of age.

Exclusion criteria included previous spinal surgery; spinal disorders (such as vertebral fracture, spinal stenosis, spondylolisthesis, inflammatory or neoplastic disease); neurological and musculoskeletal pathologies; comorbidities that might affect sensory or motor function (diabetes, neuropathies, respiratory disorders, cardiovascular problems); and physical difficulties such as visual or hearing impairments that could affect test performance. In addition, patients with obesity [body mass index (BMI)>30] were not included in the study. Healthy controls had no history of chronic low back pain or spinal disorders and met the same exclusion criteria.

Sample Size Calculation

To achieve a minimum statistical power of 80%, an a priori power analysis determined that at least 29 participants per group would be required⁽¹¹⁾. This estimate was derived using SPSS Sample Power 3.0 (IBM Corporation, Armonk, NY), with an expected correlation coefficient of $r=0.50$ and a type I error rate set at $\alpha=0.05$. To compensate for potential dropouts, 30 NSCLBP patients and 30 healthy controls were included.

Evaluation Tests

All assessments were performed in a standardized sequence during a single session. Pain intensity was recorded first, followed by plantar sensory testing, static balance assessment, dynamic balance assessment, functional mobility testing, and questionnaire-based disability and depression evaluations.

Pain

Current low back pain intensity was quantified on a 10-point visual analog scale (VAS), anchored at 0 (no pain) and 10 (worst imaginable pain), with each participant self-reporting their perceived pain level at the time of assessment⁽¹²⁾.

Plantar Foot Sensation

Light Touch-pressure

Plantar light touch-pressure thresholds were evaluated at four anatomically standardized sites-the first, third, and fifth metatarsal heads, and the heel midpoint-using the Semmes-Weinstein monofilament (SWM) test (North Coast Medical, San Jose, CA, USA). At each site, two calibrated monofilaments (2.83 and 6.65) were applied perpendicularly for 1-1.5 seconds per contact, with three applications per filament. Once participants correctly perceived two out of three stimuli, the monofilament number was recorded. If there was no sensation during trials with the first thin monofilament, then a second thicker one was used⁽¹³⁾.

Vibration Sensation

Vibratory perception was evaluated at two anatomically distinct foot landmarks-the first metatarsal head and medial malleolus-using a 128 Hz tuning fork (Elcon Medical Instruments, Germany). Participants were asked to report vibration sensation from initial contact until disappearance at the measurement site. The duration of perceived vibration was timed with a digital chronometer across three consecutive trials; the mean of these measurements was retained as the outcome variable and expressed in seconds⁽¹⁴⁾.

Two-point Discrimination

Using a calibrated aesthesiometer (Baseline, White Plains, USA), spatial tactile acuity was assessed at the trans-metatarsal and heel sites via a descending-threshold protocol in which caliper separation was reduced stepwise from maximum until the participant reported loss of dual-point perception. The threshold was defined as the minimum interpoint distance yielding a consistent two-point response. The correct response of two out of three trials was recorded as the result in millimeters⁽¹⁵⁾.

Postural Control

Static Balance

To characterize static postural stability across both limbs, the one-leg standing balance test was administered bilaterally, yielding independent scores for the dominant and non-dominant extremities. Test instructions were explained to participants, who then performed the test barefoot on a flat surface.

Initial trials were performed with eyes-open. Participants assumed a unilateral stance-hands on hips, gaze locked onto a wall-mounted fixation point at eye level-prior to the examiner initiating the timing sequence. After three repetitions of the test, average times were recorded with a chronometer in seconds.

To evaluate balance under more challenging conditions, the same procedure was then repeated with eyes-closed. For the eyes-closed condition, participants closed their eyes after achieving a stable one-leg stance position, and three trials were again performed for each limb. Regardless of visual condition (eyes-open and eyes-closed), timing was discontinued when participants either achieved uninterrupted single-limb stance for the full 30-second maximum or lost balance, defined as any contralateral foot contact with the supporting surface⁽¹⁶⁾.

Dynamic Balance

The Y balance test-a well-validated measure of dynamic postural control derived from the star excursion balance test-was used to assess reach performance in three directions: anterior, posteromedial, and posterolateral. Maintaining single-leg stance on the central platform, each participant maximally extended the contralateral limb toward each target direction. Following six familiarization trials per direction, three test trials were recorded with 30-second inter-trial rest intervals; the mean of these three values (in centimeters) served as the directional outcome score. To control for limb length variation, lower extremity length was determined as the linear distance from the anterior superior iliac spine to the medial malleolus, and each directional reach distance was normalized accordingly: normalized reach (%)=(reach distance/limb length)×100⁽¹⁷⁾.

Physical Performance

The timed up and go (TUG) test served as the primary measure of functional mobility. From a standardized seated position, each participant executed a complete sit-to-stand-to-walk-to-return-to-sit sequence over a 3-meter course; chronometer-recorded completion times were averaged across three trials to yield the outcome score⁽¹⁸⁾.

Functional Assessment

Pain-related functional disability was quantified via the Turkish-validated Oswestry disability index (ODI), a self-report measure encompassing pain intensity and its perceived impact on activities of daily living⁽¹⁹⁾. Each participant read through the questionnaire independently and recorded their responses without investigator prompting.

Psychological Assessment

Psychological status was indexed using the Turkish-validated Beck depression inventory (BDI)⁽²⁰⁾. A 21-item self-report questionnaire sensitive to the severity of depressive symptoms over the prior week, the BDI was completed independently by each participant; scores were recorded and incorporated into both descriptive and inferential analyses.

Statistical Analysis

All analyses were performed in IBM SPSS (version 22.0). Continuous data are presented as mean ± standard deviation. Three distinct analytical approaches were employed: paired-

sample t-tests to detect dominant-non-dominant asymmetries in plantar sensory thresholds within the NSCLBP group; independent-samples t-tests to compare sensory, postural, and functional performance outcomes between patients and healthy controls; and Pearson correlation analyses to quantify associations between plantar foot sensation and balance and mobility variables in the patient group. Statistical significance was set at $p < 0.05$ for all comparisons.

RESULTS

The two groups were well-matched at baseline: mean age approximated 37 years in each cohort, sex composition was identical (20 women and 10 men per group), and no significant between-group differences were detected for age or standing height. Body weight, however, was significantly elevated in the NSCLBP group relative to controls (73.67±12.64 kg vs. 65.40±10.13 kg, $p=0.050$). Within the patient group, mean VAS and ODI scores of 6.03±1.80 and 52.80±19.87, respectively, reflected moderate-to-severe pain intensity and substantial pain-related functional limitation. Depressive symptom burden was markedly higher in patients than in controls, as evidenced by a nearly fivefold difference in mean BDI scores (28.60±11.11 vs. 6.20±6.32, $p < 0.001$). Medication usage was approximately 83% in the NSCLBP group. The demographic and clinical characteristics of the participants are presented in Table 1.

Within the NSCLBP cohort, plantar sensory thresholds for light touch-pressure, vibration, and two-point discrimination did not differ significantly between the dominant and non-dominant limbs (all within-group $p > 0.05$). By contrast, comparisons with healthy controls revealed a consistently inferior level of plantar sensory performance in the NSCLBP group. Specifically, NSCLBP patients demonstrated higher SWM values, shorter vibration perception times, and larger two-point discrimination distances than healthy controls across all tested plantar regions. Relative to healthy controls, individuals with NSCLBP demonstrated inferior postural and functional performance, characterized by reduced one-leg stance duration, diminished Y balance reach distances in the anterior, posteromedial, and posterolateral directions, and prolonged TUG times (all between-group $p < 0.05$). Detailed findings are presented in Table 2.

In the NSCLBP group, dominant-side plantar sensory measures were significantly associated with postural balance and physical performance. Higher SWM values and larger two-point discrimination distances were generally associated with shorter one-leg stance times, lower Y balance reach values, and longer TUG durations, whereas longer vibration perception times were associated with better balance and mobility outcomes. Collectively, the results indicate that diminished plantar sensory function is closely associated with decrements in static and dynamic balance as well as functional mobility among patients with NSCLBP. Detailed correlation coefficients for these relationships are reported in Table 3.

Table 1. Demographic, clinical, and self-reported outcome characteristics of the NSCLBP and healthy control groups

	NSCLBP (n=30) Mean ± SD	Healthy controls (n=30) Mean ± SD	p-value
Sex [female/male, n (%)]	20 F/10 M (67%/33%)	20 F/10 M (67%/33%)	-
Age (years)	37.17±10.21	37.69±10.90	0.844
Height (cm)	169.73±10.26	170.00±8.03	0.609
Weight (kg)	73.67±12.64	65.40±10.13	0.050
VAS	6.03±1.80	-	-
Medication use (%)	83.3	-	-
BDI	28.60±11.11	6.20±6.32	p<0.001*
ODI	52.80±19.87	2.87±7.11	p<0.001*

Independent-samples t-test, *: p<0.05, NSCLBP: Non-specific chronic low back pain, SD: Standard deviation, VAS: Visual analog scale, BDI: Beck depression inventory, ODI: Oswestry disability index

Table 2. Between-group comparison of plantar sensory thresholds, static and dynamic balance, and functional mobility in NSCLBP patients and healthy controls, with within-patient dominant–non-dominant comparisons

Evaluation criteria	NSCLBP patients (n=30) dominant Mean ± SD	NSCLBP patients (n=30) non-dominant Mean ± SD	Healthy controls (n=30) dominant Mean ± SD	Healthy controls (n=30) non-dominant Mean ± SD	p-value	p-value (within)
Light touch sensation (SWM units)						
1 st metatarsal head	3.96±0.41	3.88±0.48	3.20±0.38	3.29±0.58	p<0.05	0.222
3 rd metatarsal head	4.08±0.57	4.05±0.45	3.14±0.35	3.13±0.37	p<0.05	0.764
5 th metatarsal head	4.07±0.44	4.14±0.37	3.30±0.37	3.40±0.35	p<0.05	0.284
Heel midpoint	4.36±0.41	4.33±0.45	3.54±0.36	3.52±0.32	p<0.05	0.535
Vibration sensation (s)						
1 st metatarsal head	9.31±2.70	9.43±2.87	13.22±3.08	14.91±4.04	p<0.05	0.687
Medial malleolus	8.94±2.35	8.94±2.35	12.43±2.45	12.88±3.17	p<0.05	0.994
Two-point discrimination (cm)						
Trans-metatarsal	2.36±0.67	2.37±0.70	1.61±0.43	1.60±0.38	p<0.05	0.937
Heel midpoint	2.06±0.62	2.21±0.57	1.72±0.39	1.65±0.37	p<0.05	0.247
Static balance (s)						
Eyes-open	15.86±5.88	16.28±6.68	28.24±4.42	27.26±4.21	p<0.05	0.565
Eyes-closed	6.11±3.53	6.25±3.88	15.91±3.49	14.74±3.81	p<0.05	0.721
Y balance test (cm)						
Anterior	67.76±12.59	66.84±12.38	82.43±8.07	82.62±6.97	p<0.05	0.181
Posteromedial	55.10±12.11	56.30±14.16	77.13±7.68	76.23±7.15	p<0.05	0.307
Posterolateral	66.50±11.04	65.53±11.35	82.88±6.82	84.01±7.28	p<0.05	0.392
TUG (s)	7.59 ±1.24	-	4.19±1.05	-	p<0.05	-

Between-group p-values were calculated using the independent-samples t-test. Within-group p-values were calculated using the paired-samples t-test for dominant versus non-dominant side comparisons in the NSCLBP group. Higher SWM values and larger two-point discrimination distances indicate poorer plantar sensory function; shorter vibration perception times indicate reduced vibration sensation; lower static balance and Y balance values and higher TUG values indicate worse performance. NSCLBP: Non-specific chronic low back pain, SWM: Semmes-Weinstein monofilament, TUG: Timed up and go

Table 3. Correlations of dominant-side plantar sensory measures with static balance, dynamic balance, and functional mobility in patients with NSCLBP

	Static balance (eyes-open)	Y balance anterior (A)	Y balance posterolateral (PL)	Y balance posteromedial (PM)	TUG
Light touch sensation					
1 st metatarsal head	r=-0.748** p<0.001	r=-0.391** p=0.002	r=-0.496** p<0.001	r=-0.576** p<0.001	r=0.697** p<0.001
3 rd metatarsal head	r=-0.633** p<0.001	r=-0.316* p=0.014	r=-0.456** p<0.001	r=-0.561** p<0.001	r=0.571** p<0.001
5 th metatarsal head	r=-0.631** p<0.001	r=-0.574** p<0.001	r=-0.446** p<0.001	r=-0.594** p<0.001	r=0.689** p<0.001
Heel midpoint	r=-0.696** p<0.001	r=-0.478** p<0.001	r=-0.600** p<0.001	r=-0.696** p<0.001	r=0.770** p<0.001
Vibration sensation					
1 st metatarsal head	r=0.608** p<0.001	r=0.437** p<0.001	r=0.523** p<0.001	r=0.487** p<0.001	r=-0.556** p<0.001
Medial malleolus	r=0.672** p<0.001	r=0.487** p<0.001	r=0.577** p<0.001	r=0.541** p<0.001	r=-0.583** p<0.001
Two-point discrimination					
Trans-metatarsal	r=-0.723** p<0.001	r=-0.257* p=0.047	r=-0.416** p=0.001	r=-0.482** p=0.001	r=0.660** p<0.001
Heel midpoint	r=-0.328* p=0.010	r=-0.080 p=0.542	r=-0.151 p=0.249	r=-0.273* p=0.035	r=0.344* p=0.007

Pearson correlation analysis, *: p<0.05, **: p<0.01, NSCLBP: Non-specific chronic low back pain, SWM: Semmes-Weinstein monofilament, TUG: Timed up and go, Y balance sub-directions; A: Anterior, PL: Posterolateral, PM: Posteromedial, Higher SWM values indicate reduced light touch sensitivity; higher TUG values indicate worse functional mobility; higher static balance and Y balance values indicate better performance

DISCUSSION

This study examined the relationship between plantar foot sensation, postural balance, and physical performance in patients with NSCLBP without neurological or musculoskeletal comorbidities. Compared with age- and sex-matched healthy individuals, patients with NSCLBP exhibited significant deficits in plantar light touch, vibration, and two-point discrimination, together with impaired static and dynamic balance and poorer functional performance. Collectively, these findings indicate that reduced plantar sensation is associated with impaired postural control in NSCLBP and may represent one of several factors linked to limitations in locomotor performance and body repositioning.

Altered central and peripheral sensorimotor function may reduce the ability to appropriately receive, integrate, and respond to sensory stimuli⁽²¹⁾. In this context, plantar cutaneous afferents provide continuous information regarding contact pressure, load distribution, and subtle shifts in the base of support during standing and gait. When perception from these mechanoreceptors is delayed or diminished, the timing and accuracy of postural readjustments may be reduced, thereby compromising rapid balance responses⁽²²⁻²⁴⁾. Previous studies have shown that postural control is adversely affected both in individuals with neuropathy-related loss of plantar sensation and in healthy subjects in whom plantar input was

experimentally reduced^(4,5). Plantar sensitivity also decreases with aging⁽²⁵⁾. Ito et al.⁽²⁶⁾ further reported that static balance with eyes-closed and the stereotypic ankle-hip strategy deteriorate in elderly patients with low back pain when proprioceptive signals from the gastrocnemius muscle are disturbed. Conversely, dynamic balance has been shown to improve after brief periods of plantar cutaneous stimulation in healthy subjects, and stimulation of plantar mechanoreceptors may facilitate postural control^(27,28). Taken together, these observations suggest that plantar sensory input may contribute to the proprioceptive weighting process required for stable stance and coordinated postural strategies. Consistent with this body of evidence, we found reduced plantar foot sensation in patients with NSCLBP, and this finding was associated with poorer postural control in our cohort.

Postural control deficits in NSCLBP have previously been reported, particularly during challenging or constrained tasks^(29,30). Static and dynamic balance have also been identified as important factors related to the presence and persistence of chronic low back pain^(31,32). Our findings are in agreement with these reports, as the NSCLBP group in the present study showed significantly reduced one-leg stance performance and lower Y balance test reach distances in the anterior, posterolateral, and posteromedial directions under both eyes-open and eyes-closed conditions. In this respect, our results are broadly consistent with the balance deficits described by Tsigkanos et al.⁽²⁹⁾ and with the view that altered postural control is a

clinically relevant feature of chronic low back pain⁽²⁹⁻³²⁾. In contrast, Hemmati et al.⁽³³⁾ suggested that postural balance may not be impaired in relatively young NSCLBP patients with mild pain scores. That discrepancy may partly reflect differences in patient characteristics, since their cohort had a mean age of 24 years and a mean pain intensity of 4 on the VAS, whereas our cohort had a mean age of approximately 37 years and a mean pain score of approximately 6. Tsigkanos et al.⁽²⁹⁾ also reported that age and BMI significantly influence dynamic balance. Accordingly, we excluded participants with BMI greater than 30 kg/m² or age over 50 years to reduce the potential confounding effect of these factors. Nevertheless, body weight remained significantly higher in the NSCLBP group, and this difference should be considered when interpreting the between-group balance and functional performance findings. Although obesity was excluded, the observed weight difference may still have influenced postural control and mobility outcomes to some extent.

Individuals with chronic low back pain generally report lower levels of physical activity and functional capacity than healthy peers^(34,35). Concomitant impairments in static and dynamic balance are also associated with poorer performance in functional tasks^(6,36). In addition, decreased plantar foot sensation can negatively affect physical performance in chronic conditions even in the absence of overt neuropathy⁽³⁷⁾. In agreement with this literature, patients with NSCLBP in our cohort had significantly worse TUG performance and higher disability scores than healthy controls. Thus, our findings are broadly consistent with prior reports showing reduced functional capacity and altered postural control in chronic low back pain⁽³⁴⁻³⁶⁾, while also extending these observations by demonstrating that such impairments coexist with measurable deficits in plantar cutaneous sensation. However, habitual physical activity level was not directly assessed in the present study; therefore, its potential contribution to the observed between-group differences in balance, mobility, and plantar sensory performance cannot be excluded. We also found higher depressive symptom scores in the NSCLBP group, which is in keeping with previous reports that psychological burden frequently accompanies chronic low back pain⁽³⁸⁾.

From a rehabilitation perspective, these findings suggest that plantar sensory assessment may complement conventional pain- and disability-oriented evaluation in patients with NSCLBP. Interventions targeting sensorimotor function, such as progressive balance training, proprioceptive single-leg stance and reach exercises, and plantar sensory stimulation strategies, may be considered as part of individualized conservative rehabilitation programs, although their specific effects in this population should be confirmed in prospective interventional studies^(27,28,30,35).

Study Limitations

Some limitations of this study should be acknowledged. First, exclusion of peripheral neuropathy and other relevant

neurological conditions was based on clinical history and neurological examination, whereas electrophysiological confirmation was not systematically performed. Therefore, subclinical peripheral neuropathy cannot be completely excluded. Likewise, additional radiological investigations were not systematically available beyond routine clinical evaluation; thus, subclinical structural pathology also cannot be entirely ruled out. The same limitation applies to the healthy control group, and more extensive testing in asymptomatic volunteers would raise ethical and practical concerns. Second, the sample size was relatively small and the study was conducted at a single center, which limits the broader generalizability of our findings. Accordingly, these results should be interpreted primarily as data from a specific clinical setting and should be confirmed in larger multicenter cohorts. In addition, habitual physical activity level was not assessed. Because physical activity may influence plantar sensory function, postural balance, and physical performance, its potential confounding effect cannot be excluded. Third, we focused specifically on plantar cutaneous sensation and did not evaluate other components of sensorimotor control such as lower-limb muscle strength or joint position sense. Future studies including radiologically confirmed NSCLBP subgroups, larger and more diverse samples, and interventional designs targeting plantar mechanoreceptor stimulation and balance training are warranted to clarify the direction and clinical significance of these associations.

CONCLUSION

Patients with NSCLBP showed impaired plantar sensation, poorer balance, and reduced physical performance compared with healthy controls. Plantar sensory measures were also significantly associated with balance and functional mobility in the NSCLBP group. These findings support an association between plantar sensory dysfunction and impaired postural control in NSCLBP. Further prospective studies are required to clarify the direction and clinical implications of this relationship.

Ethics

Ethics Committee Approval: The study protocol was reviewed and approved by the Local Ethics Committee of Üsküdar University (approval no: 61351342-/2019-461, date: 24.10.2019).

Informed Consent: Written informed consent was secured from every participant following comprehensive disclosure of the study protocol and procedures, as required prior to formal enrolment.

Footnotes

Authorship Contributions

Surgical and Medical Practises: Y.E., B.M., Concept: Y.E., B.M., S.K., Design: Y.E., B.M., S.K., Data Collection or Processing: Y.E., B.M., Analysis or Interpretation: Y.E., B.M., M.A.Ç., Literature Search: Y.E., B.M., M.A.Ç., S.K., Writing: Y.E., B.M., M.A.Ç., S.K.

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