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The Effects of Kinesiological Taping and Exercise on Pain, Proprioception, Sleep, and Psychological State in Individuals with Bruxism

Bruksizmi Olan Bireylerde Kinezyolojik Bantlama ve Egzersizin Ağrı, Propriyosepsiyon, Uyku ve Psikolojik Durum Üzerine Etkisi

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ABSTRACT

Objective: Bruxism, characterized by involuntary teeth grinding or clenching, can lead to pain, functional impairments, and reduced quality of life. This study aimed to evaluate the effects of combining kinesiology taping with exercise on pain, temporomandibular joint (TMJ) range of motion, sleep quality, depression levels, and cervical proprioception in individuals with bruxism.

Materials and Methods: A total of 30 participants were randomly assigned to two groups: a conventional therapy (CT) group and a conventional exercise + kinesiology taping (KT) group. Both groups underwent a two-week treatment program. Pain, cervical joint position sense (CJPS), range of motion (ROM), sleep quality, and depression levels were assessed before and after treatment.

Results: Both groups showed significant improvements in pain, depression levels, and sleep quality after treatment ($p<0.05$). The KT group demonstrated enhanced CJPS and maximum mouth opening, while the CT group showed significant improvements in ROM ($p<0.05$). However, no significant differences were found between the groups in any outcomes ($p>0.05$).

Conclusions: The findings of this study indicate that exercise exerts beneficial effects on pain, sleep quality, depressive symptoms, and joint functionality in individuals diagnosed with bruxism. Comparable positive outcomes were observed when exercise was applied alone and in combination with kinesiology taping; however, the addition of taping did not confer any additional clinical benefit.

Keywords: Bruxism, exercise, kinesiology taping, physiotherapy

ÖZ

Amaç: Bruksizm, istemsiz diş sıkma veya gıcırdatma ile karakterize olup ağrıya, fonksiyonel bozulmalara ve yaşam kalitesinde azalmaya yol açabilir. Bu çalışmanın amacı, kinezyoloji bantlaması ile egzersizin birlikte uygulanmasının, bruksizmi olan bireylerde ağrı, temporomandibular eklem (TME) hareket açıklığı, uyku kalitesi, depresyon düzeyi ve servikal propriyosepsiyon üzerindeki etkilerini değerlendirmeyi amaçlamaktadır.

Materyal ve Metot: Çalışmaya toplam 30 katılımcı rastgele geleneksel tedavi (GT) grubu ve geleneksel egzersiz + kinezyolojik bantlama (KT) grubuna ayrıldı. Her iki grup da iki haftalık bir tedavi programına dahil edildi. Tedavi öncesi ve sonrası ağrı, servikal eklem pozisyon hissi (CJPS), hareket açıklığı (ROM), uyku kalitesi ve depresyon düzeyleri değerlendirildi.

Bulgular: Tedavi sonrasında her iki grupta da ağrı, depresyon düzeyleri ve uyku kalitesinde anlamlı iyileşmeler sağlandı ($p<0,05$). KT grubunda servikal eklem pozisyon hissi (CJPS) ve maksimum ağız açıklığında, GT grubunda ise hareket açıklığında (ROM) belirgin gelişmeler gözlendi ($p<0,05$). Ancak, tedavi sonrası elde edilen tüm sonuçlar açısından iki grup arasında istatistiksel olarak anlamlı bir fark bulunmadı ($p>0,05$).

Sonuç: Bu çalışma, egzersizin bruksizmi olan bireylerde ağrı, uyku kalitesi, depresyon düzeyleri ve eklem fonksiyonu üzerinde olumlu etkileri olduğunu göstermektedir. Egzersizin tek başına veya kinezyoloji bantlaması ile birlikte uygulanmasında benzer olumlu sonuçlar elde edilmiştir; ancak bantlamanın ek bir klinik fayda sağlamadığı görülmüştür.

Anahtar Kelimeler: Bruksizm, egzersiz, fizyoterapi, kinezyolojik bantlama

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INTRODUCTION

Bruxism, once defined solely as teeth clenching or grinding, is now recognized as a complex motor activity that may occur during sleep (sleep bruxism) or wakefulness (awake bruxism), with potential physiological or protective functions.[1] Sleep bruxism involves rhythmic or sustained muscle activity, while awake bruxism is characterized by repetitive tooth contact and mandibular movements.[1] The global prevalence of sleep and awake bruxism is reported as 15.9% and 23.8%, respectively, while in Turkey, these rates are 14.1% and 28.2%, with a combined prevalence of 38.8%.[2] Bruxism is a multifactorial condition influenced by psychosocial, biological, genetic, and environmental factors. Gender-related hormonal differences, particularly in women, may affect the severity and prevalence of both temporomandibular disorders (TMDs) and bruxism.[3] Although the role of morphological features remains debated, psychosocial factors, especially stress and anxiety, are increasingly acknowledged as key contributors, particularly in awake bruxism.[4,5]

The main objectives of bruxism treatment include pain relief, reduction of muscle tension, restoration of normal temporomandibular joint function, improvement of sleep quality, and enhancement of overall quality of life.[6] Although there is no definitive treatment for bruxism, both invasive and non-invasive methods are used. Recently, reversible and non-invasive approaches such as exercise, electrical stimulation, manual therapy, and kinesiology taping have gained prominence due to their safety and patient comfort, making them increasingly preferred in clinical practice.[7,8]

Physiotherapy for bruxism focuses on pain relief, jaw function, and muscle relaxation.[9] Bruxism is a centrally mediated behavioral activity, while TMDs are musculoskeletal disorders with local pathology. Though related, bruxism is a separate clinical condition and a potential risk factor for TMD.[10]

Kinesiology taping is used to support muscle function, improve proprioception, and reduce pain, and may be as effective as occlusal splints in managing bruxism symptoms.[11,12] Bruxism is closely linked to poor sleep quality and elevated psychological distress.[13] Thus, evaluating both physical and psychosocial outcomes is crucial in assessing treatment effectiveness.

This study aims to investigate the combined effects of kinesiology taping and exercise on pain, proprioception, sleep quality, and psychological status in individuals with bruxism. Existing literature offers limited evidence on the integrated use of these interventions, particularly regarding proprioceptive outcomes. Therefore, this study seeks to provide novel insights into multidisciplinary physiotherapy approaches for improving sensorimotor function and overall symptom management in bruxism.

MATERIALS AND METHODS

Ethics Committee Approval: Ethical approval was obtained from the Non-Interventional Clinical Research Ethics Committee of Istanbul Medipol University (Date: 08.06.2023, decision no: 526). All procedures adhered to the ethical standards set forth in the Declaration of Helsinki for research involving human subjects. Informed consent was obtained from all participants prior to their enrollment in the study.

Study Design: This single-blind, randomized study included 36 participants aged 20–55 years, diagnosed with bruxism at Batident Clinic based on dental history, clinical signs (e.g., tooth wear, jaw discomfort), and masticatory muscle examination. Individuals with prior temporomandibular joint (TMJ) trauma/surgery, facial pain (e.g., sinusitis, neuralgia), inflammatory TMJ conditions, cervical limitations, recent bruxism treatment, or kinesiology tape allergy were excluded. Of the 52 individuals assessed, 16 were excluded or declined participation. Participants were randomly assigned (1:1) to either a Conventional Exercise (CE) group (n=17) or a Kinesiology Taping (KT) group (n=19) using randomizer.org. During the study, 4 participants from the KT group and 2 from the CE group withdrew. All participants were blinded to group allocation and intervention content.

Interventions:

Conventional Exercise Group: Each participant in the study received patient education and a brochure detailing the prescribed exercises to be performed as a home program three days per week for a duration of two weeks. The brochure included isometric neck exercises and temporomandibular joint range of motion exercises, such as protrusion and retrusion movements. To ensure correct and controlled execution, participants were instructed to perform all exercises in front of a mirror. Each exercise was accompanied by step-by-step instructions, visual illustrations, and specified repetition counts. The exercise protocol was designed to be simple, reproducible, and feasible for home application.[14] Participants were contacted via phone every four days to monitor their adherence and to provide individualized feedback. Based on these follow-ups, the number of sets for each exercise was adjusted according to individual needs. The two-week intervention period was selected based on previous findings suggesting that short-term interventions can lead to clinically meaningful improvements in proprioception and symptom relief among individuals with bruxism.[11,15] Additionally, shorter programs may enhance patient compli-

ance and facilitate applicability in routine physiotherapy practice. Importantly, isometric neck exercises were intentionally performed in different joint positions (e.g., neutral, shortened, and lengthened), while ensuring appropriate head and neck alignment to optimize activation of the targeted cervical muscle groups and proprioceptive stimulation. This approach is supported by literature indicating that performing isometric contractions at varied joint angles stimulates muscle spindles and joint receptors across a broader range, thereby contributing to improvements in joint position sense.[16] (Figure 1)

Kinesiology Taping Group: In the KT group, kinesiology taping was applied to the temporomandibular region alongside the conventional exercise program. A 24-hour patch test using a 2×2 cm tape on the inner forearm was conducted to screen for allergic reactions. Participants with adverse skin responses were excluded. Taping was performed every three days for two weeks by a certified physiotherapist using 5 cm-wide Kinesio® Tape Tex Gold. The tape edges were rounded to prevent peeling, and skin was prepared to ensure proper adhesion. During application, participants maintained relaxed facial and cervical posture without jaw clenching. The tape was cut into a Y-shape, stretched 10–15%, and applied over the masseter muscle.[11,15] (Figure 2).

Outcome Measures: The participants were evaluated at baseline and after the two-week intervention for pain intensity, jaw joint range of motion, joint position sense, psychological status using the Beck Depression Inventory, and sleep quality using the Pittsburgh Sleep Quality Index.

Pain: The Visual Analog Scale (VAS) is a tool used to measure the intensity of pain experienced by an individual on a scale from 0 to 10. A score of 0 rep-



Figure 1. Conventional Exercise Program.



Figure 2. Kinesiology Taping Application.

resents no pain, while a score of 10 indicates unbearable pain. Pain assessment was conducted through palpation of the masseter and temporalis muscles, which are commonly involved in bruxism-related discomfort.[17]

Assessment of Range of Motion: The active TMJ range of motion was measured in centimeters using a linear ruler. Maximum mouth opening, lateral movements (right and left), and protrusion were assessed by measuring the distance between the teeth during specific mandibular movements. During these assessments, the participants were seated in an upright position with their heads in a neutral alignment and their eyes directed forward. For the mouth opening measurement, the mandible was allowed to move freely, and the maximum vertical distance between the upper and lower central incisors was measured in centimeters using a ruler.[18]

Cervical Joint Position Error Test: The Cervical Joint Position Error Test assesses an individual's ability to return their head to its original neutral position after performing maximal rotation in the transverse and sagittal planes. In this study, cervical joint position sense was assessed using a laser pointer and target system. Participants performed head movements (flexion, extension, right and left rotation) with eyes open and then closed, and the deviation from the original neutral position was measured to determine joint position error.[19]

Beck Depression Inventory: The Beck Depression Inventory (BDI) is a 21-item questionnaire that evaluates the severity of depression symptoms. Each item is scored from 0 to 3, yielding a total score between 0 and 63. Higher scores indicate greater levels of depression, categorized as minimal, mild, moderate, or severe.[20]

The Pittsburgh Sleep Quality Index: The Pittsburgh Sleep Quality Index (PSQI) assesses sleep quality based on seven components, each scored from 0 to 3. The total score ranges from 0 to 21, with scores above 5 indicating poor sleep quality. The majority of items are completed through participant self-reporting.[21]

Statistical Analysis: Data were analyzed using IBM SPSS Statistics v26. Descriptive statistics included frequency, percentage, mean, SD, median, minimum, and maximum. Scale reliability was assessed with Cronbach's Alpha (≥0.60 acceptable). Normality was evaluated via skewness (±2) and kurtosis (<7). Between-group comparisons used the Independent Samples t-test; within-group comparisons used the Paired Samples t-test. A p-value <0.05 was considered statistically significant.

RESULTS

A total of 30 participants were included in the study, with 15 in the Conventional Therapy (CT) group and 15 in the Kinesiology Tape (KT) group. The mean age was 32.13 ± 10.58 years in the CT group and 36.73 ± 10.92 years in the KT group. The gender distribution differed notably between the groups: in the CT group, 11 participants (73%) were male and 4 (27%) were female, whereas in the KT group, only 1 participant (7%) was male and 14 (93%) were female. The mean Body Mass Index (BMI) was 26.19 ± 4.80 kg/m² in the CT group and 23.78 ± 3.98 kg/m² in the KT group. There were no statistically significant differences between groups in pre-treatment measurements for pain (VAS), maximum mouth opening, protrusion, cervical joint position error flexion, right rotation and left rotation (CJPE), depression (BDI), or sleep quality (PSQI). However, the KT group showed significantly higher baseline values for right and left lateral TMJ motion (p=0.001 and p=0.003) and lower CJPE in extension compared to the CT group (p=0.035) (Table 1).

Table 1. Intergroup distribution of pre-treatment measurements.

Variables	CT Group (n=15)	KT Group (n=15)	t	p	d
VAS	3.47±1.36	4.20±1.97	1.187	0.245	0.433
Maximum Mouth Opening (cm)	5.26±0.77	4.87±0.79	-1.361	0.184	-0.497
Right Lateral ROM °	0.93±0.18	1.41±0.48	3.584	**0.001**	1.309
Left Lateral ROM°	0.94±0.28	1.45±0.55	3.191	**0.003**	1.165
Protrusion	0.45±0.20	0.72±0.47	2.014	0.054	0.735
Cervical Joint Position Error Flexion°	9.49±7.01	7.47±3.49	-0.996	0.328	-0.364
Cervical Joint Position Error Extension°	9.83±6.63	5.43±3.91	-2.218	**0.035**	-0.810
Cervical Joint Position Error Right Rotation°	10.75±7.24	9.47±6.89	-0.493	0.626	-0.180
Cervical Joint Position Error Left Rotation°	10.50±4.62	9.30±6.63	-0.575	0.570	-0.210
Beck Depression Inventory	10.67±5.96	14.27±7.16	1.497	0.146	0.547
Pittsburgh Sleep Quality Index	5.80±3.19	6.13±2.50	0.318	0.753	0.116
Age (yrs)	32.13±10.58	36.73±10.92	-	-	-
Male, n (%)	11 (%73)	1 (7)	-	-	-
Female, n (%)	4 (%27)	14 (93)	-	-	-
BMI	26.19±4.80	23.78±3.98	-	-	-

CT: Conventional Therapy Group; KT: Kinesiology Tape Group; ROM: range of Motion; VAS: Visual Analog Scale. Statistical Method: Independent Samples t-test for between-group comparisons; BMI: Body Mass Index.

VAS significantly decreased in both groups: from 3.47±1.36 to 1.80±1.26 in the CT group (p<0.05, d=1.235), and from 4.20±1.97 to 2.13±1.77 in the KT group (p=0.001, d=1.154). Maximum mouth opening also improved significantly, increasing from 5.26±0.77 cm to 5.54 ± 0.76 cm in the CT group (p=0.004, d= -0.909), and from 4.87±0.79 cm to 5.23±0.77 cm in the KT group (p<0.05, d= -1.253). Right lateral ROM increased from 0.93 ± 0.18° to 1.11 ± 0.18° in the CT group (p=0.009, d= -0.808), and from 1.41 ± 0.48° to 1.58 ± 0.67° in the KT group (p=0.104, d= -0.449). Similarly, left lateral ROM showed improvement in the CT group (0.94±0.28° to 1.07±0.29°, p=0.036, d= -0.620), while the change in the KT group was not significant (1.45±0.55° to 1.51±0.51°, p=0.464, d= -0.194). Protrusion increased significantly in the CT group (0.45±0.20 to 0.58±0.19, p=0.003, d= -0.945), but not in the KT group (0.72±0.47 to 0.82±0.35, p=0.140, d=-0.404). Regarding CJPE, flexion improved significantly in the KT group (7.47±3.49° to 5.09±2.57°, p=0.024, d=0.656), but not in the CT group (9.49±7.01° to 8.52±5.63°, p=0.625, d=0.133). Similarly, improvements were observed in extension (KT: p=0.045, d=0.568; CT: p=0.234, d=0.332), right rotation (KT: p=0.049, d=0.558; CT: p=0.354, d=0.256), and left rotation (KT: p=0.012, d=0.741; CT: p = 0.001, d = 1.185), with the KT group showing statistically significant reductions in all directions except flexion in the CT group. Psychological parameters also improved significantly. BDI scores decreased from 10.67±5.96 to 6.07±3.45 in the CT group (p=0.002, d=1.040), and from 14.27±7.16 to 7.73±5.69 in the KT group (p=0.004, d=0.899). Likewise, PSQI scores improved in both groups (CT: 5.80±3.19 to 4.93±2.49, p=0.010, d=0.797; KT: 6.13±2.50 to 4.20±2.11, p=0.005, d=0.847) (Table 2).

Table 2. Comparison of within-group changes in pre- and post-treatment measurements for the groups.

	CT Group					KT Group				
	Pre-tre	**Post-tre**	**t**	**p**	**d**	**Pre-tre**	**Post-tre**	**t**	**p**	**d**
VAS	3.47±1.36	1.80±1.26	4.620	**0.0001**	1.235	4.20±1.97	2.13±1.77	4.468	**0.001**	1.154
Maximum Mouth Opening (cm)	5.26±0.77	5.54±0.76	-3.400	**0.004**	-0.909	4.87±0.79	5.23±0.77	-4.852	**0.0001**	-1.253
Right Lateral ROM°	0.93±0.18	1.11±0.18	-3.025	**0.009**	-0.808	1.41±0.48	1.58±0.67	-1.738	0.104	-0.449
Left Lateral ROM°	0.94±0.28	1.07±0.29	-2.320	**0.036**	-0.620	1.45±0.55	1.51±0.51	-0.752	0.464	-0.194
Protrusion	0.45±0.20	0.58±0.19	-3.537	**0.003**	-0.945	0.72±0.47	0.82±0.35	-1.563	0.140	-0.404
Cervical Joint Position Error Flexion°	9.49±7.01	8.52±5.63	0.499	0.625	0.133	7.47±3.49	5.09±2.57	2.540	**0.024**	0.656
Cervical Joint Position Error Extension°	9.83±6.63	7.78±4.24	1.243	0.234	0.332	5.43±3.91	4.09±2.45	2.198	**0.045**	0.568
Cervical Joint Position Error Right Rotation	10.75±7.24	8.71±5.97	0.958	0.354	0.256	9.47±6.89	7.01±5.28	2.160	**0.049**	0.558
Cervical Joint Position Error Left Rotation°	10.50±4.62	5.37±3.04	4.433	**0.001**	1.185	9.30±6.63	4.53±2.46	2.868	**0.012**	0.741
Beck Depression Inventory	10.67±5.96	6.07±3.45	3.890	**0.002**	1.040	14.27±7.16	7.73±5.69	3.481	**0.004**	0.899
Pittsburgh Sleep Quality Index	5.80±3.19	4.93±2.49	2.982	**0.010**	0.797	6.13±2.50	4.20±2.11	3.281	**0.005**	0.847

CT: Conventional Therapy Group; KT: Kinesiology Tape Group; ROM: range of motion; VAS: Visual Analog Scale. Statistical Method: Paired Samples t-test for within-group comparisons; Pre-tre: Pre-treatment; Post-tre: Post-treatment.

Despite these within-group improvements, no statistically significant differences were found between the CT and KT groups when comparing post-treatment change scores for any outcome variable ($p>0.05$ for all). Between-group effect sizes were small (e.g., VAS: d=–0.249; BDI: d=–0.318; PSQI: d=–0.593), suggesting that kinesiology taping did not yield superior outcomes over conventional exercise alone (Table 3).

Table 3. Comparison of the differences in measurements between pre- and post-treatment across groups.

Variables	CT Group (n=15)	KT Group (n=15)	t	p	d
VAS	-1.67±1.40	-2.07±1.79	-0.682	0.501	-0.249
Maximum Mouth Opening (cm)	0.28±0.32	0.36±0.29	0.722	0.476	0.264
Right Lateral ROM°	0.17±0.22	0.17±0.39	0.001	0.999	0.001
Left Lateral ROM°	0.13±0.22	0.06±0.31	-0.746	0.462	-0.272
Protrusion (cm)	0.13±0.14	0.10±0.25	-0.364	0.719	-0.133
Cervical Joint Position Error Flexion°	-0.97±7.50	-2.39±3.64	-0.660	0.515	-0.241
Cervical Joint Position Error Extension°	-2.05±6.40	-1.33±2.35	0.409	0.686	0.149
Cervical Joint Position Error Right Rotation°	-2.04±8.24	-2.46±4.41	-0.174	0.863	-0.064
Cervical Joint Position Error Left Rotation°	-5.13±4.49	-4.77±6.44	0.181	0.858	0.066
Beck Depression Inventory	-4.60±4.58	-6.53±7.27	-0.872	0.391	-0.318
Pittsburgh Sleep Quality Index	-0.87±1.13	-1.93±2.28	-1.623	0.116	-0.593

CT: Conventional Therapy Group; KT: Kinesiology Tape Group; ROM: range of motion; VAS: Visual Analog Scale. Statistical Method: Independent Samples t-test for comparison of change scores between groups.

DISCUSSION AND CONCLUSION

This study demonstrated that both exercise and kinesiology taping effectively improved pain, jaw mobility, cervical proprioception, sleep quality, and depressive symptoms in individuals with bruxism. Although intergroup differences were not significant, greater improvements in cervical joint position sense and sleep quality were observed in the taping group, highlighting the value of combined interventions targeting both jaw and cervical regions.

Findings support the growing evidence that supervised jaw exercises, especially with stretching, are effective for TMD, as confirmed by a recent network meta-analysis.[22] Additionally, improved cervical proprioception in the taping group aligns with research linking TMD and bruxism to cranio-cervical sensorimotor deficits.[23-25] Kinesiology taping may enhance joint position sense by stimulating mechanoreceptors, and previous studies have shown it reduces cervical joint position error.[26] These results underscore the importance of incorporating cervical-focused strategies in bruxism rehabilitation.

Our study demonstrated significant reductions in jaw pain and improvements in mandibular range of motion following an exercise and kinesiology taping protocol. These findings align with existing evidence supporting physiotherapy as an effective approach for managing TMD and bruxism. Zhang et al. reported that jaw exercises are as effective as stabilization splints in improving pain and mouth opening.[27] Similarly, Kadıoğlu et al. found that an 8-week physiotherapy program reduced TMD pain and symptom severity in bruxism patients.[14] Conservative interventions were shown to be as effective as occlusal appliances in improving function.[13,28] Although some studies suggest that adding kinesiology taping to exercise enhances outcomes.[28] We found no additional benefit, possibly due to differences in taping techniques or shorter treatment duration. This contrasts with findings by Yazici et al., who reported immediate pain reduction with taping and manual therapy in bruxism.[15] Notably, our protocol did not include manual therapy, which may have influenced results. Overall, these findings support the use of multimodal physiotherapy including exercise, taping, and manual techniques as a non-invasive, evidence based strategy for TMD and bruxism management.[13,14,27,28]

This study observed a reduction in self-reported depression levels following the intervention, highlighting the link between bruxism and psychological well-being. Psychological factors such as stress, anxiety, and depression play a key role in the etiology and severity of bruxism.[13] Bruxism is often considered a psychosomatic condition, with higher anxiety levels frequently reported among affected individuals.[13] Improvements in mood may result from reduced pain and improved sleep, while pre-existing psychological distress may also contribute to bruxism onset.[29] The type of bruxism may influence this relationship: while stress and anxiety are linked to both awake and sleep bruxism, depression appears more closely associated with awake bruxism.[30] These findings underscore the importance of incorporating stress management and psychological support into physiotherapeutic care.

The improvements in sleep quality observed in individuals with bruxism emphasize the importance of addressing sleep-related factors in physiotherapy. Bruxism is frequently associated with disrupted

sleep architecture, psychological distress, and increased daytime fatigue.[22,29] Evidence suggests that physiotherapeutic interventions, such as exercise and manual therapy, can reduce pain and enhance sleep quality.[14] By targeting nocturnal muscle hyperactivity, these approaches may help restore healthier sleep patterns. Therefore, sleep assessment should be considered a routine component of physiotherapy in bruxism management.

In conclusion, both exercise and kinesiology taping were effective in alleviating bruxism symptoms and enhancing physical and psychological well-being. However, limitations such as short intervention duration, lack of long-term follow-up, gender imbalance, and unassessed sleep-related factors should be addressed in future studies with larger and more diverse populations.

Ethics Committee Approval: Ethical approval was obtained from the Non-Interventional Clinical Research Ethics Committee of Istanbul Medipol University (Date: 08.06.2023, decision no: 526). All procedures adhered to the ethical standards set forth in the Declaration of Helsinki for research involving human subjects. Informed consent was obtained from all participants prior to their enrollment in the study.

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

Author Contributions: Concept – SC, BM; Supervision – SC, BM; Materials – SC, BM; Data Collection and/or Processing – SC, BM; Analysis and/or Interpretation – SC, BM; Writing –SC, BM.

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