Preferences in Sleep Position Correlate With Nighttime Paresthesias in Healthy People Without Carpal Tunnel Syndrome

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Abstract

Background: Carpal tunnel syndrome has been associated with sleep position preferences. The aim of this study is to assess self-reported nocturnal paresthesias and sleeping position in participants with and without carpal tunnel syndrome diagnosis to further clinical knowledge for preventive and therapeutic interventions. **Methods:** A cross-sectional survey study of 396 participants was performed in young adults, healthy volunteers, and a patient population. Participants were surveyed on risk factors for carpal tunnel syndrome, nocturnal paresthesias, and sleep preferences. Binary logistic regression analysis was performed comparing participants with rare and frequent nocturnal paresthesias. Subanalyses for participants without carpal tunnel syndrome under and over 21 years of age were performed on all factors significantly associated with subclinical compression neuropathy in the overall population. **Results:** Thirty-three percent of the study population experienced nocturnal paresthesias at least weekly. Increased body mass index ($P < .001$) and sleeping with the wrist flexed ($P = .030$) were associated with a higher frequency of nocturnal paresthesias. Side sleeping was associated with less frequent nocturnal symptoms ($P = .003$). In participants without carpal tunnel syndrome, subgroup analysis illustrated a relationship between nocturnal paresthesias and wrist position. In participants with carpal tunnel syndrome, sleeping on the side had a significantly reduced frequency of nocturnal paresthesias. **Conclusion:** This study illustrates nocturnal paresthesias in people without history of carpal tunnel syndrome including people younger than previously reported. In healthy patients with upper extremity subclinical compression neuropathy, sleep position modification may be a useful intervention to reduce the frequency of nocturnal symptoms prior to developing carpal tunnel syndrome.

Keywords: carpal tunnel, paresthesias, sleep, nocturnal paresthesias, sleep position

Introduction

Approximately 1 million adults in the United States are affected by carpal tunnel syndrome annually,⁴ leading to an estimated 400 000 surgeries performed each year.²⁷ Patients suffering from carpal tunnel syndrome have worse health-related quality of life in addition to worse physical functioning and pain compared with the general population.⁶ Several risk factors have been associated with the development of carpal tunnel syndrome including age,^{10,30,36,39} body mass index (BMI),^{5,28,30,31,35} pregnancy, wrist morphology,²⁷ trauma, diabetes, rheumatoid arthritis, acromegaly, and hypothyroidism.³⁶ Nocturnal paresthesias are a well-established clinical feature of carpal tunnel syndrome and a frequent complaint of patients with compression neuropathy.

Recent popular literature has discussed the involvement of posture in upper extremity pain and neuropathy symptoms.^{15,50}

In carpal tunnel syndrome specifically, 1 study illustrated an association between sleep position and the development of nocturnal paresthesias.²⁷ As our awareness of the influence of posture in upper extremity pain and paresthesias evolves, an association between sleeping position (our nocturnal posture) and subclinical compression neuropathy is an interesting and novel opportunity for study and possible intervention.

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The aim of this study is to assess self-reported nocturnal paresthesias and sleeping position in participants with and without a diagnosis of carpal tunnel syndrome to further clinical knowledge for preventive and therapeutic interventions.

Materials and Method

A cross-sectional study using an anonymous online survey of 420 participants was performed at a single institution (Washington University in St Louis). Research Ethics Board approval was obtained. Participation was voluntary and uncompensated, and the participant was able to withdraw from the study at any time. Participants were recruited from 3 sources: an online volunteer database (Volunteer for Health) that included adult volunteers above 23 years of age, patients with a carpal tunnel syndrome diagnosis presenting to hand surgery clinic, and a young adult population (university students in undergraduate premedical programs and first year medical school at Washington University in St Louis). This younger population was specifically recruited with the intent to explore whether the American Academy of Pediatrics' recommendation to lie infants in supine position to sleep^{1,41,45} would influence adult sleeping preferences. The student population recruited was born as this recommendation was being implemented. An a priori sample size calculation was performed¹⁶ using an expected proportion from the studies by McCabe et al^{27,28} 5% margin of error and 95% confidence level, minimum sample size was 363 participants.

An anonymous 34-item online survey (SurveyMonkey Inc) was distributed between May and October 2015 to participants. Survey questions were based on previous research²⁹ and included basic demographic information (gender, age, height and weight for BMI calculations, smoking, medication, and alcohol use), sleep quality, sleep position preferences, and frequency of nighttime numbness and tingling or waking (see Supplemental File for full survey). The survey was composed by a nurse practitioner in the Division of Plastic and Reconstructive Surgery and further reviewed and revised by a research nurse and an attending physician within the division. The survey was piloted to test reliability of questions and ease of use among staff members in the Department of Surgery. The survey included a validated screening tool for insomnia, the Insomnia Severity Index.^{8,43} Participants were also surveyed regarding carpal tunnel syndrome diagnosis or prior surgical intervention for carpal tunnel syndrome. Known risk factors for carpal tunnel syndrome (wrist position, thyroid disease, diabetes, pregnancy, occupational factors) were also surveyed.^{9,12,18,25,44,46}

Statistical Analysis

Statistical analysis was performed using SPSS version 22 (IMB Corp, Armonk, New York). Predetermined risk factors

for nighttime paresthesias (gender, sleep position, elbow and wrist position, age, BMI, carpal tunnel syndrome diagnosis, smoking status, diabetes, and thyroid disease) were chosen from the literature and were included in regression modeling. An ordinal logistic regression model using forced-entry of all the predetermined risk factors was built to determine the relative association of predetermined risk factors on the incidence and frequency of nighttime paresthesias, numbness, and tingling. Subsequent binary multiple logistic regression analysis was performed to determine significant predictors for stepwise increases in the frequency of nighttime numbness and tingling. Best-fit modeling using the Hosmer-Lemeshow Goodness of Fit test indicated good fit ($P = .600$) when frequency was grouped into 2 categories: Rare (participants reporting never or twice a week or less) or Frequent (participants reporting paresthesias sometimes or several times a week or more). P values less than .05 were considered statistically significant. Possible interactions between risk factors were not assessed.

Further subgroup analyses were performed. Binary logistic regression analysis was implemented for factors associated with nighttime paresthesias in young participants (age below 21 years) and in older participants (age 21 years or older). To better focus this subgroup analysis, we excluded patients with a previous diagnosis of carpal tunnel syndrome, thyroid disease, or diabetes. Insomnia scores were divided into 2 groups (clinical vs subthreshold)^{8,43} and compared between Rare and Frequent paresthesias using chi-square test.

Results

Demographics

Four hundred twenty participants responded to the survey. This was an overall response rate of 41.1%. Response rates were 48.4% in students, 53.2% in the Volunteer for Health population, and 19.9% in patients. Three hundred ninety-six responses (94.3%) were included in the analysis, excluding 24 participants with incomplete surveys. Participants included 128 males (32.3%) and 268 females (67.7%), 197 students, 130 volunteers, and 69 former or current hand clinic patients (Table 1). The mean age of participants was 38.8 years (range, 17-87 years). Of the total population responding to the survey, 163 participants (41.1%) were young adults (age 21 years or younger) 145 participants (36.6%) were older than 21 years and had no documented history of carpal tunnel syndrome. Eighty-five participants (21.5%) had a prior diagnosis of carpal tunnel syndrome. Of those participants with a prior diagnosis of carpal tunnel syndrome, 26 (30.6%) were male and 59 were female (69.4%).

Thirty-three percent of all participants experienced nocturnal paresthesia at least weekly. Figure 1 demonstrates

Table 1. Demographics of Survey Participants by Age Group.

Characteristic	Age category			Total (N = 396)
	Age <21	Age 21-40	Age >40	n (%)
Number of participants, n (%)	139 (25.1%)	94 (23.7%)	163 (41.2%)	396
Gender				
Female, n	92	57	119	268 (67.7%)
Male, n	47	37	44	128 (32.3%)
Carpal tunnel syndrome diagnosis, n	1	8	76	85 (21.5%)
Diabetes, n	0	1	19	20 (5.1%)
Thyroid disease, n	1	2	26	29 (7.3%)
Smoker, n	0	4	13	17 (4.3%)
Nighttime paresthesias greater than twice per week, n (%)	7 (5.0%)	15 (16.0%)	33 (20.2%)	55 (13.9%)
Clinical insomnia (based on Insomnia Score ^{15,16}), n	10	12	32	54 (13.8%)
Body mass index, mean (SD)	22.5 (3.4)	24.7 (5.7)	29.8 (6.4)	26 (6.3)

Figure 1. Incidence of nighttime paresthesias by age category. Those above 40 years were most likely to have frequent (greater than twice a week) nocturnal paresthesias.

nighttime numbness and tingling by age group. Frequent nocturnal paresthesias were defined as greater than 2 episodes per week. Of the total population, 13.9% reported nighttime paresthesias greater than twice per week ($n = 55$, 13.9%). Frequent nocturnal paresthesias were most common in participants older than age 40 years ($n = 33$, 20.2%). Only 5% of participants below the age of 21 years had nighttime paresthesias more than twice per week ($n = 7$, 5.0%). Table 2 demonstrates the frequency of nighttime paresthesias (numbness and tingling), reported by age group and history of carpal tunnel surgery. Those who experi-

enced frequent nocturnal paresthesias were significantly more likely to exhibit clinical insomnia as rated on the Insomnia Severity Index,^{8,43} $\chi^2(1, N = 396)$, $P < .0001$. The phi coefficient was 0.366 indicating a medium effect of paresthesias on insomnia.¹⁷ Sleep position preference was grouped into 3 categories based on self-reported preferred position while falling asleep and self-reported common waking positions: side sleeping only, occasional side sleeping, and no side sleeping. Forty-five percent of respondents preferred side sleeping only, 33% reported occasional side sleeping, and 22% reported never sleeping on their side. As

Table 2. Frequency of Nighttime Paresthesias Reported by Age Category and Previous History of Carpal Tunnel Surgery.

Age in years (n)	History of carpal tunnel surgery	Frequency of nighttime paresthesias				
		Never	<1 per month	1-2 per week	Several times per week	Most nights of the week
<21 (139)	Yes, n	0	0	0	1	0
	No, n	63	46	23	4	2
	Total, n (%)	63 (45.7%)	46 (33.3%)	23 (16.4%)	5 (2.9%)	2 (1.5%)
21-40 (94)	Yes, n	0	2	2	1	3
	No, n	42	21	13	9	2
	Total, n (%)	42 (44.7%)	23 (24.5%)	15 (16.0%)	10 (10.6%)	5 (5.3%)
>40 (163)	Yes, n	24	19	12	10	11
	No, n	37	26	13	8	4
	Total, n (%)	61 (37.4%)	45 (27.6%)	25 (15.3%)	18 (11.0%)	15 (9.2%)

Table 3. Binary Logistic Regression Analysis Comparing Participants Experiencing Rare Versus Frequent Nighttime Paresthesias.

Characteristic	B	SE	Wald	df	P	Exp(B)	95% confidence interval of odds ratio	
							Lower	Upper
Age	0.013	0.010	1.648	1	.199	1.013	0.993	1.033
Female gender	0.371	0.355	1.094	1	.296	1.449	0.723	2.905
Body mass index	0.093	0.026	12.807	1	.000	1.098	1.043	1.156
Smoker	0.237	0.707	0.112	1	.738	1.267	0.317	5.064
Thyroid disease	-0.722	0.680	1.195	1	.274	0.486	0.133	1.772
History of carpal tunnel syndrome	2.066	0.631	10.735	1	.001	7.892	2.293	27.158
History of carpal tunnel surgery	-1.327	0.673	3.890	1	.049	0.265	0.071	0.992
Sleep position			10.77	2	.005			
Side sleeping	-1.380	0.459	9.046	1	.003	0.252	0.102	0.616
Occasional side sleeping	-0.228	0.434	0.276	1	.599	0.796	0.340	1.863
Elbow flexed/bent sleep position	19.788	7201.8	0.000	1	.998		0.000	
Wrist flexed/bent sleep position	0.998	0.459	4.730	1	.030	2.712	1.104	6.664

Note. Nagelkerke pseudo $R^2 = 0.288$. Results significant at $P < .05$ are bolded.

age increased in the study population, the likelihood of sleeping only in a lateral position increased ($P = .003$).

Logistic Regression Analysis

Ordinal logistic regression analysis was performed for the overall population for nighttime numbness and tingling. A diagnosis of carpal tunnel syndrome was associated with increased episodes of nighttime numbness and tingling ($P = .001$), as was increasing BMI ($P = .025$). Factors with a significantly lower frequency of nighttime numbness and tingling included side sleeping ($P = .003$) and previous carpal tunnel surgery ($P = .047$).

Using binary logistic regression to examine participants organized into rare or frequent nighttime paresthesias, BMI ($P < .001$) and carpal tunnel syndrome diagnosis ($P = .001$) were significantly associated with self-reported frequent

nighttime numbness and tingling, compared with those experiencing the symptoms rarely. Sleeping with the wrist flexed was significantly associated with frequent nocturnal paresthesias ($P = .03$). Sleeping position ($P = .005$), particularly side sleeping ($P = .003$), was significantly associated with decreased nighttime numbness and tingling (Table 3).

Subgroup Analysis

Participants without a history of carpal tunnel syndrome were analyzed as separate subgroups based on age. Participants without a preference for wrist position, and those with medical risk factors for carpal tunnel syndrome, were excluded from the analysis. In participants born in 1994 or later (young adults below 21 years), those who preferred sleeping with the wrist straight reported significantly less nighttime paresthesias than those with other wrist positions

Table 4. Binary Regression Analysis of Young Participants (Age Below 21 Years) for Characteristics Associated With Nighttime Paresthesias.

Characteristic	B	SE	Wald	df	P	Odds ratio	95% confidence interval for odds ratio	
							Lower	Upper
Female gender	0.289	0.899	0.104	1	.747	1.336	0.229	7.781
Body mass index	0.114	0.135	0.717	1	.397	1.121	0.860	1.461
Sleep position			1.094	2	.579			
Side sleeping	-18.597	6016.012	0.000	1	.998	0.000	0.000	
Occasional side sleeping	1.247	1.192	1.094	1	.296	3.478	0.336	35.976
Wrist straight sleep position	-2.169	0.896	5.866	1	.015	0.114	0.020	0.661

Note. n = 101. Nagelkerke $R^2 = 0.336$. Results significant at $P < .05$ are bolded.

Table 5. Binary Regression Analysis of Older Participants (Age Above 21 Years Old) for Characteristics Associated With Nighttime Paresthesias.

Characteristic	B	SE	Wald	df	P	Odds ratio	95% confidence interval for odds ratio	
							Lower	Upper
Age	-0.043	0.028	2.352	1	.125	0.958	0.907	1.012
Female gender	-2.517	1.483	2.878	1	.090	0.081	0.004	1.478
Body mass index	0.181	0.058	9.842	1	.002	1.199	1.070	1.342
Sleep position			1.388	2	.500			
Side sleeping	-1.133	0.985	1.321	1	.250	0.322	0.047	2.222
Occasional side sleeping	-0.516	0.999	0.267	1	.605	0.597	0.084	4.227
Wrist straight sleep position	-1.875	0.777	5.825	1	.016	0.153	0.033	0.703

Note. n = 85. Nagelkerke $R^2 = 0.408$. Results significant at $P < .05$ are bolded.

($P = .015$). There was no significant relationship with gender, BMI, or sleeping position preference and the frequency of nighttime numbness and tingling (Table 4).

In participants born prior to 1993 (above 21 years old) and without a diagnosis of carpal tunnel syndrome, increasing BMI was significantly associated with increased nighttime paresthesias ($P = .002$) (Table 5). Sleeping with the wrist straight was associated with less frequent episodes of nocturnal paresthesias ($P = .016$).

Discussion

Many factors have been identified as contributing to the development of carpal tunnel syndrome. In the current study, BMI and previous diagnosis of carpal tunnel syndrome were associated with nocturnal paresthesias as well as body and wrist position during sleeping. There is just one previous study²⁹ that has evaluated sleep position as a potential cause of carpal tunnel syndrome in spite of the fact that nocturnal paresthesias are a common presenting symptom, and night wrist splinting is the recognized first treatment for carpal tunnel syndrome.^{37,49} The previous study by McCabe et al corroborates the finding that side lying was

associated with increasing age²⁷; however, it also reported carpal tunnel syndrome was associated with side lying. To our knowledge, we are the second group to focus on sleep position as a specific factor in the report of nocturnal paresthesia and potential development of carpal tunnel syndrome. The results of our study differed from McCabe et al's in that we noted side lying to be protective in experiencing nocturnal paresthesias in the overall study population.²⁷ Further investigation by stratifying survey responses from just those with a carpal tunnel syndrome diagnosis (n = 85) showed that those who preferred lateral sleeping position had significantly lower frequency of nighttime paresthesias (regression coefficient -1.608 ± 0.594 ; $P = .007$) compared with carpal tunnel syndrome participants who preferred other sleeping positions. While McCabe et al's outcome measure was carpal tunnel syndrome²⁷ and this study's was nighttime paresthesias, this is still an apparent contradiction, possible reasons for which are discussed further in limitations. This cross-sectional survey study demonstrates the presence of nighttime numbness and tingling throughout all age groups in healthy volunteers without preexisting carpal tunnel syndrome. This study illustrates the presence of nocturnal paresthesia in age groups younger than

typically studied for compression neuropathy. Carpal tunnel syndrome peaks in incidence between 50 and 54 years and again at 75 and 84 years of age.^{10,15,30} The presence of nocturnal paresthesias in young participants may be related to cumulative lifestyle, ergonomic, or postural factors unique to the modern generation (computer and smart phone use) that are beyond the scope of the current survey.²⁶ Results of this survey indicate nocturnal paresthesias may contribute to insomnia (phi coefficient 0.366). Similarly, 2 recent studies demonstrate the negative effect of carpal tunnel on sleep.^{37,38} Sleep deprivation is a recent topic of interest and has been shown in meta-analyses of sleep studies to strongly impair human functioning in cognitive, motor, mood, and physiologic disease process realms. While hand symptoms are generally the focus of repairing carpal tunnel syndrome, there is a need for hand surgeons to be mindful of sleep dysfunction²⁰; this study adds to literature showing treatment of carpal tunnel symptoms may decrease insomnia, improving sleep^{37,38} and thereby daytime performance.

While most study participants who experience nighttime numbness and tingling likely do not suffer from carpal tunnel syndrome, the younger population in this study may represent subclinical compression neuropathy exacerbated by positioning. Improving these symptoms may improve sleep and daytime functioning. Our data demonstrate that sleeping with the wrists in a neutral position is associated with less self-reported nighttime paresthesias. These younger participants with subclinical symptoms may be amenable to conservative management and lifestyle modification. Improving posture during sleep by focusing on wrist position could decrease symptom severity. In the overall study group, sleeping in a lateral or side-sleeping position was associated with less frequency of nighttime paresthesias. Based on this study, closer attention to wrist and body position during sleep is a valuable target for intervention that may reduce nighttime paresthesias in symptomatic patients both with and without electrodiagnostic evidence of carpal tunnel syndrome. Interventions in middle and older age categories should continue to focus on weight management and management of chronic disease risk factors for carpal tunnel syndrome.

Sleep position as a possible causative factor for carpal tunnel syndrome has been rarely studied²⁷; however, ergonomic and biomechanical studies have illustrated that certain upper extremity positions lead to increased pressure on the median nerve.¹⁴ Shoulder abduction, elbow extension, forearm supination, and wrist and finger extension lead to the greatest strain on the median nerve while increasing degrees of elbow flexion correlate with an increased strain on the ulnar nerve.^{14,48,49} Prolonged and highly repetitive flexion or extension of the wrist increases the risk of carpal tunnel syndrome, especially when applied with a forceful grip, and ergonomic adjustments have been suggested in the workplace.^{7,24,33,36,47,49} Conservative management typically

begins with nighttime wrist splinting in a neutral position as it is thought wrist malposition during sleep acutely exacerbates symptoms of carpal tunnel syndrome by increasing the pressure in the carpal canal, particularly with contractions of the wrist and finger flexor muscles such as sleeping with hands in a fist position.^{11,14,19,23,42} Wrist splinting can include a modification to extend the metacarpal phalangeal (MCP) joints to prevent fisting while sleeping (Table 6). Table 6 includes recommendations on sleeping and posture modification for patients with upper extremity compression neuropathy.^{2,13}

A substantial percentage of those with electrodiagnostic evidence of carpal tunnel syndrome suffered from clinically significant sleep disturbances in addition to sleeping 2.5 hours less per night than the National Sleep Foundation's recommended amount.³⁷ It is unclear if a particular sleep position is predictive of carpal tunnel syndrome; however, our results suggest that those who sleep in a lateral position experience less nighttime numbness and tingling. With respect to the younger student population recruited in this study, in 1992, the American Academy of Pediatrics recommended supine sleeping to decrease the incidence of sudden infant death syndrome,^{1,41,45} and in 1994, the National Institute for Child Health and Human Development launched a back to sleep public education campaign.⁴¹ Our student population would have been infants during or after this time. McCabe and Xue have noted that as age increases the proportion of sleeping in the lateral position increases.²⁹ Similarly, we found that older participants were more likely to sleep in side-lying position than participants below 20 years of age. The younger population in this study did show a decreased preference for lateral lying and it is possible, though unproven, that the back to sleep practice may affect adults' preference for sleep positions.

Limitations of this study include the limitations of studying a multifactorial disease using a self-reported survey. The model was not a perfect fit suggesting covariates affecting nighttime paresthesias not captured in the survey, patient population, or statistical model. Our analysis also did not assess interactions between risk factors. For example, older participants tended to sleep in the lateral position; this study does not tease out the separate effects of age and lateral sleep position on nocturnal paresthesias. The best sleep position for prevention of the nocturnal paresthesia in this study was lateral side lying. By contrast, this was associated with increased carpal tunnel symptoms in the studies by McCabe et al.^{27,28} This discrepancy likely relates to the reliability of self-reported sleep positioning; however, overall differences in study populations should not be discounted. The mean age of the overall study population was almost 14 years younger than that of the studies by McCabe et al,^{27,28} and 41% of our participants were younger than 21 years of age. This percentage of younger participants was composed of premedical and medical students. It is possible, although

Table 6. Recommendations for Sleep Positions to Reduce Upper Extremity Paresthesias.

All upper extremity compression neuropathies	<ol style="list-style-type: none"> 1. Maintain neutral cervical spine position; assess pillow height to prevent excessive cervical side bending. 2. Avoid sleeping side lying on the involved side. 3. Avoid prone sleeping.
Median nerve compression neuropathies	<ol style="list-style-type: none"> 1. Maintain neutral wrist position; if necessary use a wrist splint in neutral (0°-10° extension) or a PI block splint which maintains the metacarpal phalangeal joints in extension and limits the lumbrical muscles jamming in the proximal palm.² 2. Position arm on a pillow in front when in side lying to keep the forearm in neutral and limiting drag on the proximal structures. 3. Avoid positioning the involved arm in 90° shoulder abduction and external rotation (median neural tension). 4. Avoid fisting; a splint should be worn at night to prevent this (potentially increased tension on the flexor digitorum superficialis arch/median forearm). 5. Avoid placing the hand under the face/head.
Ulnar nerve compression neuropathies	<ol style="list-style-type: none"> 1. Avoid elbow flexion >30°. Consider towel splinting to limit flexion if one is unable to comply with this.¹² 2. Do not lie on the involved arm. 3. When in supine avoid arm abduction (90° overhead) where neural tension may be increased.
Radial nerve compression neuropathies	<ol style="list-style-type: none"> 1. Avoid sleeping with head resting on the forearm. 2. Wear a wrist splint in extension (depending on the level of irritability) to limit stretch on the radial nerve. 3. Position forearm in neutral (thumb up) on a pillow. 4. Avoid full elbow extension, which may add stretch to involved structures.
Brachial plexus and thoracic outlet syndrome	<ol style="list-style-type: none"> 1. Sleep supine with the involved arm resting on a pillow to decrease drag proximally. 2. To improve tolerance of supine, place a pillow under the knees to decrease pull on the low back. 3. In severe cases of pain in supine, a towel roll under the shoulder may relieve the stretch on the pectoralis minor and lessen symptoms. 4. Pillow choice is important to assure that there is no traction on the plexus during sleep.

unproven, that this portion of the study population has lower rates of smoking^{3,32} and higher rates of computer use³⁴ than their nonmedical school counterparts which could lead to a potential bias in distribution of risk factors. Furthermore, the study population was representative of only one small geographic area and may represent characteristics that differ from the general population. The gender distribution in this study population differed from the overall population distribution.²² This can likely be attributed to the voluntary nature of the survey and the higher incidence of carpal tunnel syndrome in the female gender. While some studies suggest there is high reliability among patients when asked to recall their most common sleep position,²¹ other research suggests that self-reported body position may not match position during sleep.⁴⁰ Video research has shown people typically change body position an average of 13 times per night.²¹ The influence of the “back-to-sleep” campaign on sleep position preference later in life is something this study was not capable of assessing and is a topic for future studies requiring collaboration with fields outside of plastic surgery. Finally, nocturnal paresthesias likely have multifactorial causes and contributions, and this study is only a glimpse into one of the possible contributing factors to subclinical compression neuropathy.

Conclusion

The results of this large survey indicate patients much younger than the established carpal tunnel syndrome population experience nighttime paresthesias. This may be due in part to sleep position predisposing them to subclinical compression neuropathy. People who experience nighttime paresthesias without strong electrodiagnostic evidence of carpal tunnel syndrome may benefit from early conservative intervention including nighttime splinting and sleeping position modification to reduce their nocturnal symptoms and delay or prevent the progression to clinical compression neuropathy.

Authors' Note

This study was presented at American Society of Plastic Surgeons 2016 meeting in Los Angeles, CA.

Ethical Approval

This study was approved by our institutional review board.

Statement of Human and Animal Rights

All procedures followed were in accordance with the ethical standards of the responsible committee on human experimentation

(institutional and national) and with the Helsinki Declaration of 1975, as revised in 2008. Informed consent was obtained from all patients for being included in the study.

Statement of Informed Consent

Informed consent, as approved by Washington University in St Louis Institutional Review Board, was obtained from all individual participants included in the study.

Declaration of Conflicting Interests

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

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