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Original Article

General Malaise and Physical Symptoms in Young Women with Untouched Toe

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Untouched toe is a condition in which a toe does not touch the ground while standing. It is frequently observed in women even under physiological conditions. Deformities or symptoms of the toes are not observed in these women. The clinical significance of untouched toe has not been fully elucidated. Two hundred young healthy women were recruited into the present study after informed consent. We evaluated the prevalence of untouched toe by measuring various indexes of the toe using a foot-sole-measuring equipment. We also conducted a self-administered questionnaire regarding general malaise. Untouched toe was observed in 114 of these 200 women (57.0%). The fifth toe was more frequently affected than the other toes. There were no significant differences in size of foot except the area and proportion touching the ground between women with untouched toe and those without untouched toe. The prevalence of general malaise was significantly higher in women with at least one untouched toe (57.0%) compared with those without untouched toe (43.0%) ($p < 0.05$). Twelve symptoms—irritability, headache, tired eyes, hazy vision, congested or runny nose, irregular menstruation or menstrual pain, shoulder stiffness, neck stiffness, low back pain, cold hands, swollen feet, and cold feet—were more frequently observed in women with at least one untouched toe compared with those without untouched toes. Untouched toe was associated with various symptoms of general malaise. However, the pathological mechanism by which untouched toe causes these symptoms has not been determined. Further analysis of gait and exercise habits in women with untouched toe is necessary.

Key words: cold feet, general malaise, shoulder stiffness, untouched toe, young women

Human toes work as both sensors and effectors. They are responsible for one end of the base of support provided by the foot, and play an important role in maintaining posture and ensuring stability during movement [1, 2]. However, there are few studies on the soles of the feet and toes of young women.

Untouched toe is a condition in which one or more toes do not touch the ground while standing. Untouched

toe does not constitute a pathological toe deformity that is problematic from the point of view of orthopedics, and it does not need surgery [3-6]. The potential causes of untouched toe include shoe-related factors (*i.e.*, incorrect shoe size or wearing slippers), variations in lower limb shape (O- or X-shaped legs), the effects of walking posture, and a decreased frequency of using the toes [7-10]. Previous studies revealed that the phenomenon of untouched toe is increasing because of changes in daily life patterns. It was reported that the incidence of untouched toe increased dramatically from 5-10% in 1980 to over

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50% in 2000 [11].

It is suggested that untouched toe affects upper limb movement, standing posture, and movement during daily activities and decreases balance and the ability to move the center of gravity forward [10]. Therefore, untouched toe is known to cause symptoms such as low back pain, headaches, and shoulder stiffness [7-10].

General malaise is a feeling of general discomfort or uneasiness occurring in people without definite physical disorders [12]. It has been known that young women tend to complain of general malaise more frequently than young men [12]. Although general malaise includes low back pain, headaches, and shoulder stiffness, the association between untouched toe and the other symptoms of general malaise has not been studied.

In the present study, we studied untouched toe in young women and its association with general malaise.

Materials and Methods

Subjects. Two hundred young women were

recruited into this study, which was performed from January to April 2013, after informed consent and the approval of the Ethical Committee of the Graduate School of Health Sciences, Okayama University. Women with orthopedic disease or any abnormalities in stability while standing upright were excluded from the study.

Measurement of the sole. We evaluated the sole and toes of each subject using the plantar measuring tool, Foot Look (Foot Look Co., Ltd., Fukuoka, Japan). Women stood on the Foot Look scanner while gazing steadily at a target picture located 2 meters in front of them. The plantar scan was performed after body sway had stabilized. Foot Look captures an image of the sole within approximately 15sec while subject stands on the plantar scanner [11]. The Foot Look also measures plantar pressure distribution, foot length, foot width, and both the area and proportions of the sole and toes touching the scanner (Fig. 1). All measurements were performed by a single researcher. Data from 2 measurements were taken and their average was calculated. Our preliminary study indicated that the intraclass correlation coeffi-

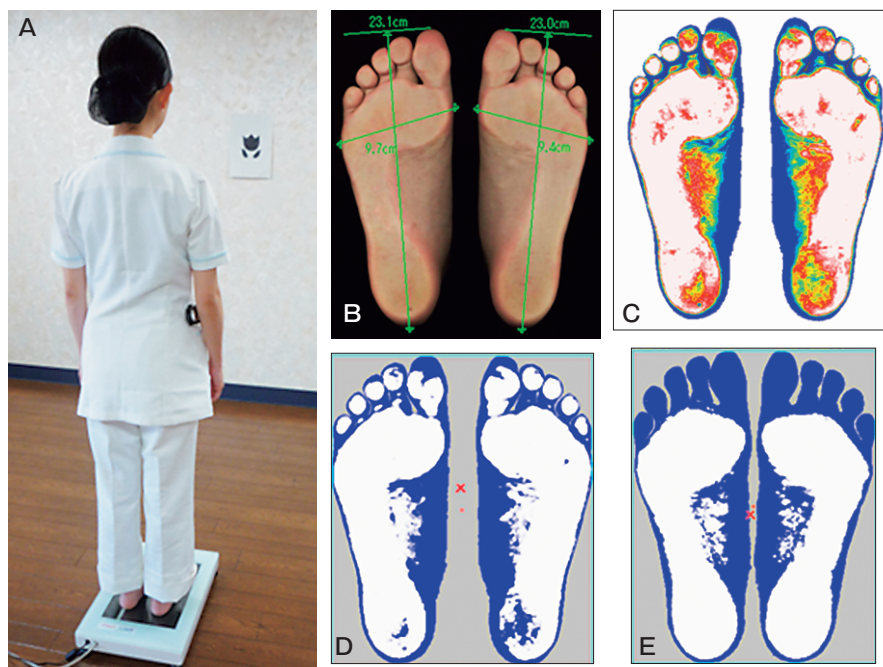


Fig. 1 Evaluation of the sole and toes using a plantar measurement device. **A**, Women stood on the Foot Look scanner and gazed steadily at a target picture located two meters in front of them; **B**, The Foot Look measures foot length, foot width, and both the area and proportions of the sole and toes touching the scanner; **C**, The Foot Look also measures plantar pressure distribution; **D**, A foot without untouched toe; **E**, Untouched toe in all toes.

cient of average measures showed good reproducibility (> 0.9) if we repeated the measurement more than twice and calculated the mean value. The status of the untouched toe was diagnosed and classified based on plantar pressure distribution [11].

Self-administered questionnaire. A self-administered questionnaire on general malaise was conducted. The questionnaire included 57 symptoms of general malaise (the National Livelihood Survey by the Ministry of Health, Labour and Welfare, Japan [12]).

Statistical analysis. Statistical analyses, *t*-tests, Mann-Whitney U tests, chi-square tests, or Pearson's correlation coefficients, were performed with SPSS 21 software for Windows.

Results

Age and body type. The age of the subjects was 20.7 ± 2.1 (mean \pm S.D.) years. The height and weight were 157.3 ± 5.3 cm and 54.9 ± 9.2 kg, respectively. The body mass index (BMI) was 22.1 ± 3.3 .

Untouched toe. One hundred fourteen women (57.0%) of our sample of 200 had at least one untouched toe (Table 1). The condition of the toes while standing were classified as (1) a toe that is completely touching the ground, (2) a toe, part of which does not touch the ground, and (3) a toe floating completely off the ground (untouched toe) [11].

Untouched toe was frequently observed in the fifth toe. Eighty-two women (41.0%) had 1 or 2 untouched toes while only 2 women had untouched toes in all toes. There are significant differences in area or proportion touching the ground between women with and without untouched toe (Table 2). However, there are no significant differences in the foot length, foot

width, and foot circumference between the 2 groups.

General malaise in women with untouched toe. One hundred twenty-seven women (63.5%) had at least one symptom of general malaise. The prevalence of various symptoms of general malaise in women with at least one untouched toe were significantly higher than those in women without untouched toe ($n = 86$) (Table 3). Twelve symptoms including "irritability" and "headache" in systemic symptoms, "tired eyes" and "hazy vision" in symptoms of the eyes, "congested or runny nose" in respiratory symptoms, "irregular menstruation or menstrual pain" in urogenital symptoms, "shoulder stiffness," "neck stiffness," and "low back pain" in musculoskeletal symptoms, and "cold hands," "swollen feet," and "cold feet" in symptoms of hands and feet, were observed more frequently in women with untouched toes compared with women without untouched toes.

The more the untouched toes were observed, the more symptoms of general malaise were observed among young women with untouched toes (Table 4).

Discussion

Our study revealed that 57.0% of young women had at least one untouched toe. The prevalence of untouched toes was similar to that in our previous report in young women [11]. Untouched toes were most frequently observed in either the left and/or right fifth toe of young women.

In the present study, symptoms of general malaise were also frequently observed in young women. Women with untouched toe complained of 12 symptoms of general malaise more frequently than women without untouched toe. There are several studies indicating that shoulder stiffness, low back pain, and

Table 1 Ground contact of toe

	Great (n = 200)		Second (n = 200)		Third (n = 200)		Fourth (n = 200)		Fifth (n = 200)	
	Left	Right	Left	Right	Left	Right	Left	Right	Left	Right
Completely	106 (53.0%)	106 (53.0%)	150 (75.0%)	159 (79.5%)	170 (85.0%)	183 (91.5%)	168 (84.0%)	181 (90.5%)	72 (36.0%)	79 (39.5%)
Not completely	68 (34.0%)	73 (36.5%)	34 (17.0%)	25 (12.5%)	26 (13.0%)	10 (5.0%)	25 (12.5%)	13 (6.5%)	42 (21.0%)	36 (18.0%)
Untouched toe	26 (13.0%)	21 (10.5%)	16 (8.0%)	16 (8.0%)	4 (2.0%)	7 (3.5%)	7 (3.5%)	6 (3.0%)	86 (43.0%)	85 (42.5%)

Table 2 Measurement of sole

		Total (n = 200)	Without Untouched toe (n = 86)	Untouched toe (n = 114)	p-value
Foot length (cm)	Left	22.98 ± 0.94	23.03 ± 0.96	22.94 ± 0.93	0.515
	Right	22.98 ± 0.93	23.03 ± 0.93	22.94 ± 0.94	0.477
Foot width (cm)	Left	9.54 ± 0.48	9.50 ± 0.44	9.58 ± 0.50	0.236
	Right	9.57 ± 0.47	9.50 ± 0.44	9.62 ± 0.50	0.093
Foot circumference (cm)	Left	21.84 ± 1.28	21.75 ± 1.23	21.91 ± 1.31	0.373
	Right	21.86 ± 1.24	21.79 ± 1.24	21.91 ± 1.24	0.515
Foot area (cm ²)	Left	146.89 ± 11.56	147.15 ± 11.65	146.69 ± 11.54	0.784
	Right	148.18 ± 12.60	148.26 ± 13.71	148.13 ± 11.75	0.943
Area touching the ground (cm ²)	Left	91.00 ± 12.95	94.27 ± 12.80	88.54 ± 12.56	0.002*
	Right	95.37 ± 13.10	98.16 ± 13.17	93.27 ± 12.70	0.009*
Proportion touching the ground (%)	Left	61.87 ± 7.00	64.01 ± 6.78	60.25 ± 6.75	<0.001*
	Right	64.31 ± 6.43	66.20 ± 6.17	62.88 ± 6.27	<0.001*

Mean ± S.D., *significant difference.

headache are common in people with untouched toe [7–10]. It has been known that the center of gravity deviates backward and an excessive burden is placed on the low back in persons with untouched toe [10]. These changes of the posture may result in musculo-skeletal symptoms of general malaise such as shoulder stiffness, low back pain, and headache. A previous study has shown that symptoms like shoulder stiffness, low back pain, and headache were improved with improvement of untouched toe and dynamic balance while standing [13]. Furthermore, hazy vision and tired eye in people with untouched toe are likely caused by reduced balance function, which is known to cause the center of gravity to move backward.

The present study suggested possible adverse effects of untouched toe on other symptoms of general malaise. Reduced muscle strength is likely to exist in people with untouched toe. It is possible that reduced muscle strength and subsequent impaired circulation of the extremities may be associated with cold hands, cold feet, and swollen feet in women with untouched toe.

We observed that a higher rate of young women with untouched toe had menstrual pain or irregular menstruation. Menstrual pain is believed to be mainly caused by excessive contraction of the uterus as a result of prostaglandin obstructing the intrauterine blood circulation, thereby causing ischemic pain [14]. Avoiding pelvic congestion of the blood vessels and

circulatory dysfunction and engaging in relaxation and appropriate exercise are believed to be effective for alleviating menstrual pain [14–16]. Similarly, physical stress is known to be related to irregular menstruation [15, 16]. It has been reported that changes of the center of foot pressure observed in people with untouched toe results in an unstable supporting surface of the toes, impaired accommodation of the body's load, and difficulties in walking forward. Physical stress from inappropriate walk and exercise may be related to irregular menstruation. Symptoms associated with menstruation lead to poor quality of life in young women. Further study is necessary to elucidate the mechanism causing symptoms associated with menstruation in women with untouched toe.

Our results indicated that untouched toe in young women is associated with various physical symptoms and is likely to be problematic. However, physical symptoms can be caused by various factors [15–19]. Women with untouched toe reported frequently having symptoms of general malaise such as irritability and congested or runny nose. Because these symptoms are also influenced by external factors, they cannot be indiscriminately labeled as being affected by untouched toe.

In recent years, the prevalence of untouched toe has been increasing. However, few studies have targeted young women. Further studies on untouched toe in young women need to be conducted on a larger

Table 3 Untouched toe and general malaise

	Total (n = 200)	Without Untouched toe (n = 86)	Untouched toe (n = 114)	p-value
Systemic symptom				
Body feels heavy	43 (21.5%)	15 (17.4%)	28 (24.6%)	0.297
Headache	33 (16.5%)	7 (8.1%)	26 (22.8%)	0.007*
Irritability	21 (10.5%)	4 (4.7%)	17 (14.9%)	0.002*
Forget things	17 (8.5%)	7 (8.1%)	10 (8.8%)	1.000
Cannot sleep	12 (6.0%)	3 (3.5%)	9 (7.9%)	0.240
Dizziness	11 (5.5%)	3 (3.5%)	8 (7.0%)	0.357
Have a fever	5 (2.5%)	2 (2.3%)	3 (2.6%)	1.000
Eyes				
Tired eyes	48 (24.0%)	12 (13.9%)	36 (31.6%)	0.004*
Hazy vision	17 (8.5%)	3 (3.5%)	14 (12.3%)	0.038*
Hard to see objects	14 (7.0%)	4 (4.7%)	10 (8.8%)	0.402
Ears				
Ringing in ears	10 (5.0%)	3 (3.5%)	7 (6.1%)	0.520
Hard to hear	7 (3.5%)	4 (4.7%)	3 (2.6%)	0.466
Chest				
Throbbing	10 (5.0%)	2 (2.3%)	8 (7.0%)	0.193
Pain in precordium	6 (3.0%)	2 (2.3%)	4 (3.5%)	0.701
Out of breath	5 (2.5%)	2 (2.3%)	3 (2.6%)	1.000
Respiratory system				
Congested or runny nose	23 (11.5%)	5 (5.8%)	18 (15.7%)	0.042*
Expelling cough or phlegm	14 (7.0%)	4 (4.7%)	10 (8.8%)	0.402
Wheezing	4 (2.0%)	1 (1.2%)	3 (2.6%)	0.636
Digestive symptoms				
Constipation	35 (17.5%)	13 (15.1%)	22 (19.3%)	0.460
Heavy stomach or heartburn	16 (8.0%)	3 (3.5%)	13 (11.4%)	0.063
Abdominal or stomach pain	14 (7.0%)	3 (3.5%)	11 (9.6%)	0.102
Diarrhea	5 (2.5%)	0 (0.0%)	5 (4.4%)	0.072
Loss of appetite	5 (2.5%)	2 (2.3%)	3 (2.6%)	1.000
Pain from hemorrhoids, bleeding	4 (2.0%)	0 (0.0%)	4 (3.5%)	0.136
Teeth				
Teeth hurt	8 (4.0%)	2 (2.3%)	6 (5.3%)	0.470
Swollen or bleeding gums	5 (2.5%)	1 (1.2%)	4 (3.5%)	0.393
Difficult to bite	2 (1.0%)	0 (0.0%)	2 (1.8%)	0.507
Skin				
Rash (e.g. hives, boils)	8 (4.0%)	5 (4.4%)	3 (3.5%)	1.000
Itchiness (e.g. eczema, athlete's foot)	6 (3.0%)	3 (3.5%)	3 (2.6%)	1.000
Urogenital system				
Menstrual pain - Irregular menstruation	44 (22.0%)	8 (9.3%)	36 (31.5%)	<0.001*
Frequent urination	6 (3.0%)	1 (1.2%)	5 (4.4%)	0.239
Difficult urinating	1 (0.5%)	0 (0.0%)	1 (0.9%)	1.000
Pain during urination	0 (0.0%)	0 (0.0%)	0 (0.0%)	-
Urinary incontinence (urine leaks)	0 (0.0%)	0 (0.0%)	0 (0.0%)	-
Injury				
Wound such as cut or burn	4 (2.0%)	1 (1.2%)	3 (2.6%)	0.636
Fracture, sprain, or dislocation	1 (0.5%)	0 (0.0%)	1 (0.9%)	1.000
Musculoskeletal system				
Shoulder stiffness	75 (37.5%)	19 (22.1%)	56 (49.1%)	<0.001*
Neck stiffness	52 (26.0%)	11 (12.8%)	41 (36.0%)	<0.001*
Low back pain	41 (20.5%)	9 (10.5%)	32 (28.1%)	0.002*
General back pain	11 (5.5%)	2 (2.3%)	9 (7.9%)	0.119
Muscle pain	5 (2.5%)	2 (2.3%)	3 (2.6%)	1.000
Hands				
Cold hands	41 (20.5%)	11 (12.8%)	30 (26.3%)	0.022*
Hand numbness	5 (2.5%)	0 (0.0%)	5 (4.4%)	0.072
Swollen hands	4 (2.0%)	0 (0.0%)	4 (3.5%)	0.136
Hand joints hurt	2 (1.0%)	0 (0.0%)	2 (1.8%)	0.507
Hands do not move well	0 (0.0%)	0 (0.0%)	0 (0.0%)	-
Feet				
Cold feet	65 (32.5%)	18 (20.9%)	47 (41.2%)	0.002*
Swollen feet	36 (18.0%)	7 (8.1%)	29 (25.4%)	0.003*
Heavy feet	18 (9.0%)	4 (4.7%)	14 (12.3%)	0.081
Knee pain	11 (5.5%)	2 (2.3%)	9 (7.9%)	0.119
Foot numbness	8 (4.0%)	1 (1.2%)	7 (6.1%)	0.141
Shoes rub	5 (2.5%)	1 (1.2%)	4 (3.5%)	0.393
Heel pain	3 (1.5%)	0 (0.0%)	3 (2.6%)	0.261
Foot joints hurt	2 (1.0%)	0 (0.0%)	2 (1.8%)	0.507
Forefoot pain	2 (1.0%)	0 (0.0%)	2 (1.8%)	0.507
Feet do not move well	2 (1.0%)	2 (2.3%)	0 (0.0%)	0.184
Ankle pain	1 (0.5%)	0 (0.0%)	1 (0.9%)	1.000

*significant difference.

Table 4 Number of untouched toe and symptoms of general malaise

Untouched toe	Symptoms of general malaise	
Without untouched toe (n = 86)	2.4 ± 3.6	0.7 [0-14]
Untouched toe (n = 114)		
1 (n = 27)	4.4 ± 5.7	3.0 [0-24]**
2 (n = 55)	6.0 ± 5.4	5.0 [0-21]**
3 (n = 15)	5.9 ± 5.3	5.5 [0-15]*
> 3 (n = 17)	6.2 ± 7.3	5.0 [0-23]***
Total (n = 200)	4.3 ± 5.2	2.9 [0-24]

Mean ± S.D., median [range]

vs. control (Without untouched toe), * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

scale. Analysis of gait and the center of gravity during exercise, and more detailed information about lifestyle factors including habits of walking exercise and seasonal changes of shoes should be investigated.

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