

Smartphones: Dermatologic Impact of the Digital Age

Christopher Mancuso, DO, MHS; Lauren Dozier, DO; Fatimah Sherbeny, PharmD, PhD, MS; Stanley Skopit, DO, MSE

PRACTICE POINTS

- The amount of time spent on a smartphone was found to directly correlate with skin changes to the fifth digit.
- Skin changes to the fifth digit were mostly reported to be divots (impressions) or calluses.

As smartphones continue to gain popularity, skin changes to the fifth digit caused by extended use of these devices will become more prevalent. A 20-item survey was designed to assess smartphone use and skin changes that may be associated with smartphone use. This study is an initial step in uncovering a possible phenomenon of smartphone use affecting the digits, namely the fifth digit.

Cutis. 2020;105:195-199.

Over the last decade, the use of mobile phones has changed drastically with the advent of more technologically advanced smartphones.¹ Mobile phones are no longer used primarily as devices for talking but rather for text messaging, reading the news, drafting emails, browsing websites, and connecting with others on social media. Considering the increased utility and popularity of social media along with the greater reliance on smartphones, individuals in the United States and worldwide are undoubtedly spending more time on their handheld devices.² With the increase in use and overuse of smartphones, many aspects of society and health are likely affected. Many celebrities who frequently post on social media platforms also have alluded to or directly discussed changes in their dermatologic health secondary to their increased use of smartphones.³ Numerous

studies have investigated the positive and negative effects of smartphone use on various musculoskeletal conditions of the upper extremities^{4,5} and the social effects of smartphone use on behavior and child development.^{6,7} Lee et al⁸ studied the effects of smartphone use on upper extremity muscle pain and activity in relation to 1- or 2-handed operation. In this study, Lee et al⁸ measured the muscle activity and tenderness in 10 women aged 20 to 22 years after a series of timed periods of smartphone use. They concluded that smartphone use resulted in greater muscle activity and tenderness, especially in 1-handed use compared to 2-handed use.⁸ Inal et al⁹ investigated smartphone overuse effects on hand strength and function in 102 college students and discovered that smartphone overuse was correlated with decreased pinch strength, increased median nerve cross-sectional area, and pain in the first digits.⁹

However, few articles have been published investigating skin changes to the digits in relation to smartphone use (Figure 1). In a PubMed search of articles indexed for MEDLINE using the terms *smartphone*, *phone*, *cell phone*, *electronic device*, *handheld device*, *fifth digit*, or *skin changes*, the authors were unable to find any studies in the literature that involved smartphone use and skin changes to the digits. Based on informal clinical observation and personal experiences, we hypothesized that changes to the fifth digit, likely due to holding a smartphone, would be prevalent and would correlate with amount of time spent on smartphones per day (Figure 2). We also were interested in investigating any other potential correlations with changes to the fifth digit, such as type of smartphone used.

Methods

The study used a cross-sectional design. From September 2018 to December 2018, 374 individuals 18 years or older

Dr. Mancuso is from St. John's Episcopal Hospital, Far Rockaway, New York. Drs. Dozier and Skopit are from Larkin Community Hospital, South Miami, Florida. Dr. Sherbeny is from Nova Southeastern University, Dr. Kiran C. Patel College of Osteopathic Medicine, Fort Lauderdale, Florida. The authors report no conflict of interest.

Correspondence: Christopher Mancuso, DO, MHS, 327 Beach 19th St, Far Rockaway, NY 11691 (CJMancuso@gmail.com).

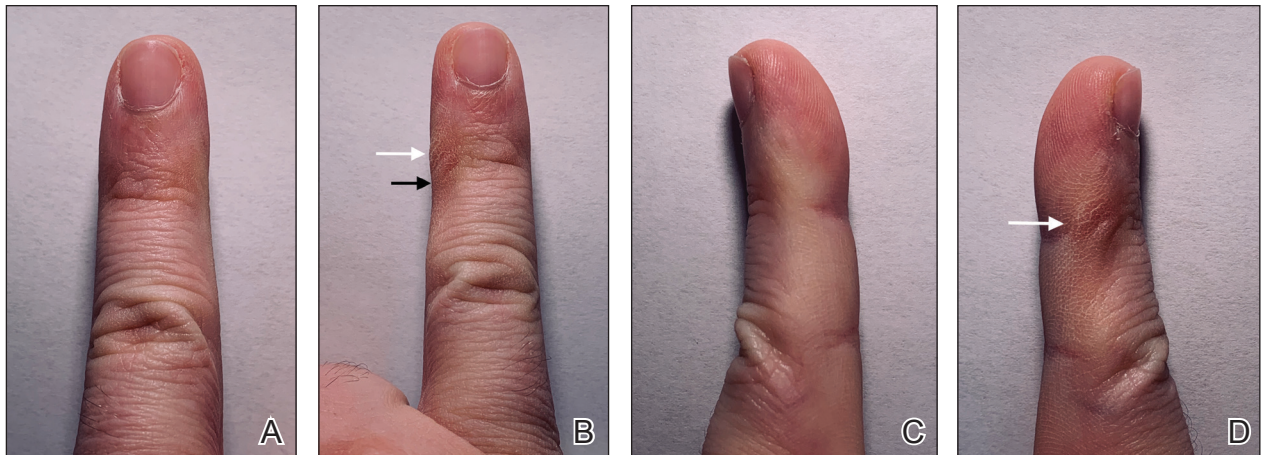


FIGURE 1. Changes to the fifth digit, likely due to extended smartphone use. This patient is right-handed and holds a smartphone with the right hand. A, Dorsal aspect of the left fifth digit. B, Dorsal aspect of the right fifth digit. C, Lateral aspect of the left fifth digit. D, Lateral aspect of the right fifth digit. Black arrow shows indentation of the skin. White arrows show scaly lichenified papule with overlying hyperpigmentation.

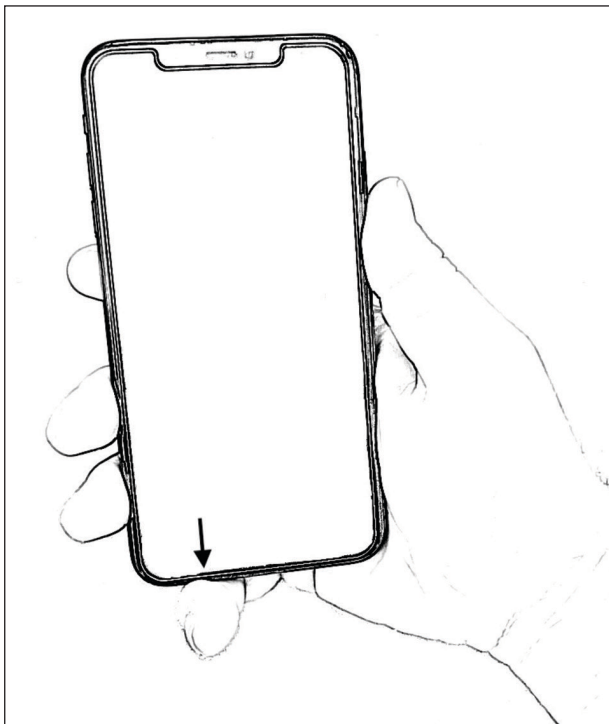


FIGURE 2. Example of a patient holding a smartphone in a way that may contribute to skin changes of the fifth digit. The patient is holding a smartphone in the right hand with the fifth digit supporting the base of the smartphone (black arrow).

were recruited to complete a 5-minute anonymous survey online. Using email referrals and social media, participants were presented with a link to a Google survey that only allowed 1 submission per account. On the first page of the survey, participants were presented with a letter explaining that completion of the survey was entirely voluntary, participants were free to withdraw from the study at any time,

and participants were providing consent in completing the survey. The protocol was determined to be exempt by the institutional review board at Nova Southeastern University (Fort Lauderdale, Florida) in September 2018.

Survey Design—A 20-item survey was designed to measure the amount of time spent using smartphones per day, classify the type of phone used, and quantify skin changes noticed by each respondent. Demographic information for each respondent also was gathered using the survey. The survey was pilot tested to ensure that respondents were able to understand the items.

One item asked if respondents owned a handheld smartphone. Two items assessed how much time was spent on smartphones per day (ie, <1 hour, 1–2 hours, 2–3 hours, 3–4 hours, 4–5 hours, >5 hours) and the type of smartphone used (ie, Apple iPhone, Samsung Galaxy, Google Pixel, Huawei, LG, other). Six items assessed skin changes to the digits, namely the fifth digit (eg, Do you notice any changes to your fifth digit [pinky finger] that would likely be contributed to how you hold your smartphone, such as divot, callus, bruise, wound, misalignment, bend?). Eleven items were used to collect basic demographic information, including age, sex, legal marital status, ethnicity, race, annual household income, highest-earned educational degree, current employment status, health insurance status, and state of residence.

Statistical Analysis—All data were analyzed using IBM SPSS Statistics 23. The association between changes to the fifth digit and time spent on the phone, hand dominance, and socioeconomic factors (ie, age, sex, legal marital status, ethnicity, race, highest-earned educational degree, current employment status, health insurance status, annual household income, state of residence) was analyzed using logistic regression, with changes to the fifth digit as the dependent variable and time spent on the phone, dominant hand, and socioeconomic factors as independent

variables. Measures of central tendency, frequencies, and other descriptive analyses were used to define the characteristics of the sample. The bivariate associations between changes to the fifth digit and time spent on the phone, hand dominance, and socioeconomic factors were examined using χ^2 analysis, correlational analysis, and *t* tests. Statistical significance was set at $P \leq .05$.

Results

The mean age of the 374 respondents was 33.8 years (range, 18–72 years). One hundred nine respondents were men (29.1%), 262 were women (70.1%), and 3 did not specify (0.8%). Two hundred thirty-four respondents (62.6%) were single, 271 (72.5%) were white, 171 (45.7%) had a bachelor's degree, and 174 (46.5%) were employed full time. Annual household income was normally distributed among the respondents, with 28 (7.5%) earning less than \$10,000 per year, 130 (34.8%) earning \$10,000 to \$49,999 per year, 136 (36.4%) earning \$50,000 to \$99,999 per year, 52 (13.9%) earning \$100,000 to \$149,999 per year, and 28 (7.5%) earning more than \$150,000 per year. The demographic characteristics of the respondents are presented in Table 1.

Eighty-five (22.7%) respondents admitted to changes to the fifth digit that they associated with holding a smartphone, whereas 289 (77.3%) reported no changes. When asked about the average amount of time spent on their smartphone per day, 17 (4.5%) respondents answered less than 1 hour, 70 (18.7%) answered 1 to 2 hours, 69 (18.4%) answered 2 to 3 hours, 77 (20.6%) answered 3 to 4 hours, 57 (15.2%) answered 4 to 5 hours, and 84 (22.5%) answered more than 5 hours. One hundred ninety-nine (53.2%) respondents indicated they used an Apple iPhone, 95 (25.4%) used a Samsung Galaxy phone, 9 (2.4%) used a Google Pixel phone, 3 (0.8%) used a Huawei phone, 23 (6.1%) used an LG phone, and 45 (12.0%) used another type of smartphone. The characteristics of smartphone use as reported by the respondents are presented in Table 2.

Comment

Consistent with our hypothesis, changes to the fifth digit were prevalent in the surveyed population, with 85 (22.7%) respondents admitting to changes to their fifth digit from holding a smartphone. The changes to the fifth digit were described as 1 or more of the following: divot (impression), callus (skin thickening), bruise, wound, misalignment, or bending. Most respondents who noted skin changes on the survey endorsed changes consistent with calluses and/or divots. These changes can be described as scaly, lichenified, well-demarcated papules or plaques with variable overlying hyperpigmentation and surrounding erythema. In cases with resulting chronic indentations of the skin, one also would observe localized sclerosis, atrophy, and/or induration of the area, which we found to be less prevalent than expected considering the popularity and notable reliance on smartphones.²

The most commonly reported chronic skin changes to the fifth digit are similar to those of lichen simplex chronicus and/or exogenous lobular panniculitis, which can be both symptomatically and cosmetically troubling for a patient. Functional impairment in movement of the fifth digit may result from the overlying lichenification and induration, as well as from lipoatrophy of the underlying traumatized subcutaneous fat, especially if the affected area is overlying the proximal interphalangeal joint of the fifth digit. These resulting alterations in the skin of the fifth digit also may be cosmetically displeasing to the patient.

On histology, we would expect similar changes to that of lichen simplex chronicus—compact hyperkeratosis and hypergranulosis—and/or an exogenous lobular panniculitis. Lobular panniculitis demonstrates necrosis of the fat lobule; vacuolated spaces; and lipomembranous changes such as fatty cystic degeneration with feathery eosinophilic material in an arabesque pattern, which has been described as frost on a windowpane, or a ferning pattern at the edge of the lipid vacuole.¹⁰

We also were correct in our hypothesis that prevalence of changes to the fifth digit correlate with amount of time spent on smartphones per day. Bivariate and multivariate logistic regression analysis showed that a change to the fifth digit was not significantly associated with hand dominance or socioeconomic factors (ie, age, sex, legal marital status, ethnicity, race, annual household income, highest-earned educational degree, current employment status, health insurance status, and state of residence). Controlling for all other factors, the only factor that significantly increased the odds of experiencing a change to the fifth digit was the amount of time spent on the phone per day. The respondents who spent more than 5 hours per day on their phones had 5-times greater odds of experiencing a change to their fifth digit compared with respondents who spent less than 1 hour per day on their phones ($P = .045$).

Although no other correlations with changes to the fifth digit, such as type of smartphone used, were found in our study, future studies should continue to investigate other potential factors that play a role in smartphone use changing the appearance and function of the digits. Our lack of significant correlations with changes to the fifth digit could be attributed to a small sample size and other possible factors, such as the frequent design changes of smartphones by manufacturers. Our study also is limited by the possibility of other factors contributing to these observed skin changes. Although we have anecdotally observed these skin changes and have hypothesized that smartphones are the culprit, other causes, such as holding certain tools, could lead to these skin changes. In addition, there are many different ways to hold a smartphone, and certain hand positionings may be more or less prone to skin changes described in our study. Various accessories, such as cases and gripping devices, also may change the way smartphones are held and would skew the results of our survey. Future studies could examine different ways

TABLE 1. Demographic Characteristics of Respondents Regarding Change to Fifth Digit

Characteristic		Respondents With No Change (n=289)	Respondents With Change (n=85)	Total Respondents (N=374)
Age, y	Mean	35.0	29.7	33.8
	Median	30	27	29
Sex, n (%)	Female	201 (69.6)	61 (71.8)	262 (70.1)
	Male	86 (29.8)	23 (27.1)	109 (29.1)
	Not specified	2 (0.7)	1 (1.2)	3 (0.8)
Marital status, n (%)	Single	178 (61.6)	56 (65.9)	234 (62.6)
	Married	83 (28.7)	24 (28.2)	107 (28.6)
	Divorced	23 (8.0)	3 (3.5)	26 (7.0)
	Other	5 (1.7)	2 (2.4)	7 (1.9)
Race, n (%)	White	217 (75.1)	54 (63.5)	271 (72.5)
	Black or African American	33 (11.4)	11 (12.9)	44 (11.8)
	Asian	19 (6.6)	12 (14.1)	31 (8.3)
	Native Hawaiian or Pacific Islander	0 (0)	1 (1.2)	1 (0.3)
	American Indian or Alaskan Native	2 (0.7)	0 (0)	2 (0.5)
	> 1 race	18 (6.2)	7 (8.2)	25 (6.7)
Annual household income, n (%)	<\$10,000	22 (7.6)	6 (7.1)	28 (7.5)
	\$10,000– \$49,999	98 (33.9)	32 (37.6)	130 (34.8)
	\$50,000– \$99,999	110 (38.1)	26 (30.6)	136 (36.4)
	\$100,000– \$149,999	39 (13.5)	13 (15.3)	52 (13.9)
	>\$150,000	20 (6.9)	8 (9.4)	28 (7.5)
Education, n (%)	High school diploma or equivalent	12 (4.2)	5 (5.9)	17 (4.5)
	Some college, no degree	48 (16.6)	14 (16.5)	62 (16.6)
	Associate's degree	18 (6.2)	9 (10.6)	27 (7.2)
	Bachelor's degree	138 (47.8)	33 (38.8)	171 (45.7)
	Master's degree	47 (16.3)	12 (14.1)	59 (15.8)
	Professional degree	6 (2.1)	12 (14.1)	28 (7.5)
	Doctorate degree	16 (5.5)	0 (0)	6 (1.6)
Employment status, n (%)	Full time	136 (47.1)	38 (44.7)	174 (46.5)
	Part time	44 (15.2)	11 (12.9)	55 (14.7)
	Out of work	21 (7.3)	7 (8.2)	28 (7.5)
	Homemaker	9 (3.1)	4 (4.7)	13 (3.5)
	Student	72 (24.9)	25 (29.4)	97 (25.9)
	Military	1 (0.3)	0 (0)	1 (0.3)
	Retired	6 (2.1)	0 (0)	6 (1.6)
Health insurance status, n (%)	Insured	269 (93.1)	80 (94.1)	349 (93.3)
	Not insured	20 (6.9)	5 (5.9)	25 (6.7)

TABLE 2. Characteristics of Smartphone Use Reported by Respondents

Characteristic		Respondents With No Change, n (%) (n=289)	Respondents With Change, n (%) (n=85)	Total Respondents, n (%) (N=374)
Dominant hand	Left	46 (15.9)	12 (14.1)	58 (15.5)
	Right	235 (81.3)	70 (82.4)	305 (81.6)
	Ambidextrous	8 (2.8)	3 (3.5)	11 (2.9)
Smartphone type	Apple iPhone	143 (49.5)	56 (65.9)	199 (53.2)
	Samsung Galaxy	79 (27.3)	16 (18.8)	95 (25.4)
	Google Pixel	8 (2.8)	1 (1.2)	9 (2.4)
	Huawei	2 (0.7)	1 (1.2)	3 (0.8)
	LG	19 (6.6)	4 (4.7)	23 (6.1)
	Other	38 (13.1)	7 (8.2)	45 (12.0)
	Time spent on phone per day	<1 h	15 (5.2)	2 (2.4)
	1–2 h	63 (21.8)	7 (8.2)	70 (18.7)
	2–3 h	53 (18.3)	16 (18.8)	69 (18.4)
	3–4 h	58 (20.1)	19 (22.4)	77 (20.6)
	4–5 h	43 (14.9)	14 (16.5)	57 (15.2)
	>5 h	57 (19.7)	27 (31.8)	84 (22.5)

smartphones are held, how various accessories affect these skin changes, and the size or model of phones that make these skin changes more or less prevalent.

Conclusion

Our study is an initial step in uncovering a possible phenomenon of smartphone use affecting the digits, namely the fifth digit. Our findings demonstrate that the amount of time spent on the phone per day significantly increases the odds of experiencing a change to the fifth digit. We expect these potential skin changes as well as other musculoskeletal changes to increase in prevalence as daily smartphone use continues to increase. With the lack of studies investigating skin changes to the digits in relation to smartphone use, future studies are needed to verify our results and confirm the presence of this issue.

REFERENCES

- Ko PH, Hwang YH, Liang HW. Influence of smartphone use styles on typing performance and biomechanical exposure. *Ergonomics*. 2015;59:821-828.
- Chang J, Choi B, Tjolleng A, et al. Effects of button position on a soft keyboard: muscle activity, touch time, and discomfort in two-thumb text entry. *Appl Ergon*. 2017;60:282-292.
- Park JH, Christman MP, Linos E, et al. Dermatology on Instagram: an analysis of hashtags. *J Drugs Dermatol*. 2018;17:482-484.
- Algar L, Valdes K. Using smartphone applications as hand therapy interventions. *J Hand Ther*. 2014;27:254-257.
- Megna, M, Gisonni P, Napolitano M, et al. The effect of smartphone addiction on hand joints in psoriatic patients: an ultrasound-based study. *J Eur Acad Dermatol Venereol*. 2017;32:73-78.
- Christensen MA, Bettencourt L, Kaye L, et al. Direct measurements of smartphone screen-time: relationships with demographics and sleep. *PLoS One*. 2016;11:E0165331.
- Lemola S, Perkinson-Gloor N, Brand S, et al. Adolescents' electronic media use at night, sleep disturbance, and depressive symptoms in the smartphone age. *J Youth Adolesc*. 2014;44:405-418.
- Lee M, Hong Y, Lee S, et al. The effects of smartphone use on upper extremity muscle activity and pain threshold. *J Phys Ther Sci*. 2015;27:1743-1745.
- Inal EE, Demirci K, Çetintürk A, et al. Effects of smartphone overuse on hand function, pinch strength, and the median nerve. *Muscle Nerve*. 2015;52:183-188.
- Elston D, Ferringer T, Ko C, et al. *Dermatopathology*. 3rd ed. New York, NY: Elsevier Health Sciences; 2018.