

Cigarette Smoking and Facial Wrinkles: A Review of the Literature

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Research studies indicate that smoking cigarettes is related to a premature development of facial wrinkles. Given that facial wrinkles may act as motivation for people to quit smoking, it is crucial that smoking cessation professionals be able to accurately inform clients about research concerning smoking and wrinkles. Therefore, the purpose of this article is to provide an updated overview of the literature which can be used by cessation clinicians as a practical reference on smoking and facial wrinkles. Databases were searched for peer-reviewed articles that study the association with smoking and wrinkles. In all, 17 articles were located and reviewed for research methods and results. Although facial wrinkles and smoking were measured inconsistently between studies, the overall literature indicates that those who smoke have a higher risk of developing premature facial wrinkles as compared to those who do not smoke. The implications of this review for smoking cessation professionals are described.

Keywords: smoking, face, wrinkles, cigarettes

The association between cigarette smoking and life-threatening diseases is well researched and widely publicised (Schane, Ling, & Glantz, 2010; US Department of Health and Human Services, 2004); however, a less recognised aspect of cigarette smoking is its toxic effect on connective tissue in the face, resulting in **slack skin and premature wrinkling** (Demierre, Brooks, Koh, & Geller, 1999; Morita, 2006). Although facial wrinkles are by no means a fatal condition, research suggests that people may perceive the development of facial wrinkles as a threat serious enough to consider quitting smoking (Grogan, Flett, Clark-Carter, Gough, Davey et al., 2010). Consequently, appearance-based smoking cessation interventions are beginning to appear in the published literature and there is emerging evidence of its effectiveness as a strategy for lowering intentions to smoke (Grogan, Flett, Clark-Carter, Conner, Davey et al., 2011; Hysert, Mirand, Giovino, Cummings, & Kuo, 2003).

Given that the **risk of forming facial wrinkles may act as a motivator to change smoking behaviours**, it is important that smoking cessation professionals be able to accurately inform their clients about the research concerning the association between smoking and wrinkles. Although litera-

ture reviews have been previously conducted on this topic (Frances, 1998; Morita, 2006), they lack the most current published studies and are typically focused toward audiences with an expertise in dermatology. Therefore, the purpose of this article is to provide an updated overview of the literature, which can be used by cessation clinicians and health educators as a practical reference on smoking and facial wrinkling.

Methods

During September of 2011, the databases PubMed, CINAHL Plus, and Google Scholar were searched using the following terms in various combinations: smoke, smoking, cigarettes, tobacco, face, facial, skin, wrinkle, crease, fold, furrow, and aging. Articles were included in the review if they were published in peer-reviewed journals and described studies that investigated the relationship between cigarette smoking and facial wrinkles. In order to conduct an exhaustive search, articles were not excluded from the review based on date of publication, location of the study, or the language in which the article was published.

Table 1

Methods and Findings From Studies on Smoking and Facial Wrinkles

Article	Sample	Study design	Measure of wrinkles	Definition of smoker(s)	Findings
Ippen & Ippen, 1965	N = 224; 35–84 years old; White	Cross-sectional study from a convenience sample.	Wrinkles part of 'smoker's face' measure: pale gray skin and wrinkles on the face.	Smoker: Ever smoked.	79% of smokers had pronounced wrinkles vs. 20% of nonsmokers.
Daniell, 1971	N = 1,104; 30–69 years old; > 98% White	Cross-sectional study from a convenience sample of patients entering a doctor's office.	Daniell's 6-point wrinkle scale.	Smoker: Ever smoked for 5 consecutive years.	Significantly more smokers in each age group had higher wrinkle ratings than nonsmokers. Smokers 40–49 years old had wrinkles similar to nonsmokers who were 60–69 years old.
Allen et al., 1973	N = 650; ages not specified; 79% White, 21% Black	Cross-sectional study from a convenience sample of patients entering a doctor's office.	Daniell's 6-point wrinkle scale.	Smoker: Smoke half-a-pack daily.	White smokers had higher, but nonsignificant, wrinkle ratings than White nonsmokers. No difference in wrinkles between Black smokers and Black nonsmokers.
Model, 1985	N = 116; 30–69 years old; White	Cross-sectional study from a convenience sample of new patients attending a general medical outpatient clinic at two hospitals.	Wrinkles part of 'smoker's face' measure: wrinkles, gauntness, and skin color.	Current smoker: Smoked ≥ 10 cigarettes/week during the last year and smoked ≥ 10 years. Past smoker: Not smoked in the last year, but smoked ≥ 10 cigarettes/week for ≥ 10 years.	46% of current smokers, 8% of past smokers, and 0% of nonsmokers were classified as having a smoker's face.
Kadunce et al., 1991	N = 132; 35–59 years old; White	Cross-sectional study from a convenience sample of smokers applying for a smoking cessation program.	5-point modification of Daniell's 6-point wrinkle scale	Smokers grouped into 0.0–0.9, 0.9–49.9, and 50+ pack-years. 1 pack-year equals smoking 1 pack/day per year.	More 0.9–49.9 and 50+ pack-year smokers had wrinkle ratings of 3.5–5 than 0–0.9 pack-year smokers (36%, 55%, 9%).
Schnohr et al., 1991	N = 6,970; 40–69 years old; White	Cross-sectional study from a random sample of people who were involved in the Copenhagen City Heart Study.	5-point modification of Daniell's 6-point wrinkle scale.	Smokers grouped into 1–19, 20–39, and 40+ pack-years.	A significant relationship was observed between cumulative cigarette consumption and deep wrinkles in men, but not women.
Ernster et al., 1995	N = 911; 40–69 years old; White	Cross-sectional study from a random sample of people who attended a health screening at a medical center in Oakland, California.	Moderate wrinkles ≤ 2 shallow wrinkles, < 2 medium wrinkles Severe wrinkles ≥ 2 medium wrinkles or any deep wrinkles.	Current smoker: Ever smoked ≥ 100 cigarettes; ever smoked ≥ 1 cigarettes/day every day; smoked within past 6 months.	Male current smokers are 2.3 times more likely to develop facial wrinkles than male nonsmokers. Female current smokers are 3.1 times more likely to develop facial wrinkles than female nonsmokers.

Table 1

Continued

Article	Sample	Study design	Measure of wrinkles	Definition of smoker(s)	Findings
Muizzuddin et al., 1997	<i>N</i> = 100; 35–56+ years old; Races not specified	Cross-sectional study from a convenience sample of volunteers from the New York, New Jersey, and Pennsylvania.	Total area of shadow produced by a light source on silicone replicas of eye area from each subject.	Active smokers: ≥ 1 pack/day \geq five years.	Active smokers had twice the amount of wrinkling as compared to nonsmokers.
Castelo-Branco et al., 1998	<i>N</i> = 730; 40–60 years old; Latino	Cross-sectional study from a convenience sample of patients from a menopause clinic in Barcelona, Spain.	Score based on mathematical formula from number, depth, and length of wrinkles.	Current smoker: Definition not provided. Former smoker: Definition not provided.	Current smokers are 2.57 times more likely to develop facial wrinkles than nonsmokers. Current smokers are 1.42 times more likely to develop facial wrinkles than former smokers.
O'Hare et al., 1999	<i>N</i> = 200; 35–75 years old; White	Cross-sectional study from a convenience sample of residents from Winston-Salem, North Carolina.	6-point wrinkle scale.	Smoker: Smoke ≥ 10 cigarettes per day.	The average wrinkle score was higher, but not significant, among smokers than nonsmokers.
Yin et al., 2001	<i>N</i> = 83; 23–95 years old; Asian	Cross-sectional study from a convenience sample of patients.	Daniell's 6-point wrinkle scale.	Current smoker: Someone who is smoking currently. Former smoker: Someone who had smoked previously	Current smokers were 27 times more likely than nonsmokers to have a Daniell wrinkle rating of ≥ 4 . Former smokers were 3 times more likely than nonsmokers to have a Daniell wrinkle rating of ≥ 4 .
Chung et al., 2001	<i>N</i> = 407; 30–92 years old; Asian	Cross-sectional study from a convenience sample of people and members of senior citizen centres.	8-point wrinkle scale.	Smoker: Having a ≥ 30 pack-year smoking history.	Those with a ≥ 30 pack-year smoking history were 2.2 times more likely than nonsmokers to have a wrinkle rating of ≥ 4 .
Aizen & Gilhar, 2001	<i>N</i> = 80; 60–92 years old; Israeli	Cross-sectional study from a convenience sample of volunteers.	5-point modification of Daniell's scale.	Smoker: ≥ 20 pack-year smoking history and who were still smoking.	Smokers had a significantly higher mean wrinkle rating (3.1) than nonsmokers (2.1).
Koh et al., 2002	<i>N</i> = 350; 20–69 years old; Asian	Cross-sectional study from a random sample of patients at a dermatologic clinic in South Korea.	5-point modification of Daniell's 6-point wrinkle scale.	Current smoker: Within the past year smoked ≥ 10 cigarettes/week. Also smoked for ≥ 10 years.	Current smokers were 2.72 times more likely than non-smokers to have a wrinkle score of ≥ 3 .
Leung & Harvey, 2002	<i>N</i> = 792; 60+ years old; Races not specified	Cross-sectional study from a random sample of those listed on a registry of general practitioners' patients.	10-point modification of Daniell's 6-point wrinkle scale.	Smoker: Not defined.	Daily cigarette consumption was significantly associated with skin ageing. Smoking 20 cigarettes per day was equivalent in effect to almost 10 years of chronological ageing.

Table 1
Continued

Article	Sample	Study design	Measure of wrinkles	Definition of smoker(s)	Findings
Doshi et al., 2007	N = 2 (twins); 52 years old; White	Case study of twins.	6-point wrinkle scale.	Smoker: Twin sister with a 52 pack-year smoking history.	The twin sister who smoked had noticeably more facial wrinkling than her sister who did not smoke. The sisters lived in the same locations their whole lives and had the same amount of sun exposure.
Raduan et al., 2008	N = 301; 25–86 years old; Brazilian	Cross-sectional study from a convenience sample of patients and patients' companions from dermatology clinics in Rio de Janeiro, Brazil.	Daniell's 6-point wrinkle scale.	Smokers grouped into 0, 0.1–39.9, and 40+ pack-years.	Smokers with 40+ pack-years had 3.92 times the risk than non-smokers to have a wrinkle score of ≥ 3 .

Results

The authors located a total of 17 peer-reviewed journal articles published between the years 1965 and 2008 (Table 1). With the exception of a case-study, each research project was cross-sectional in design and involved participants from convenience samples. The majority of studies focused on participants with white skin; however, 7 of the articles described studies on participants with different skin pigmentations. Participants ranged in age from 20 to 95 years old.

Researchers used various methods to measure facial wrinkles located at the corners of each eye, also known as 'crow's feet' wrinkles, and wrinkles located on the cheeks, lips, and forehead. In nine of the studies, researchers measured facial wrinkling by using Daniell's 6-point scale or 5- to 10-point modifications of Daniell's scale. Daniell's scale is a reliable, ordinal-based measure used to rate various degrees of wrinkling (Table 2, Figure 1; Daniell, 1971). The remaining studies used other methods for examining the relationship of smoking and facial wrinkling. In four studies, researchers used wrinkle scales not derived from Daniell's scale. Researchers in two studies placed people into dichotomous categories of either having or not having 'smoker's face', measured as having facial wrinkles, pale gray skin, and a gaunt face. In three studies, researchers used more complex means to measure wrinkles, including counting wrinkles, using high-tech photography to quantify shadows caused by wrinkles, and rating wrinkles based from a mathematical formula on the number, depth, and length of wrinkles.

Each article defined smokers differently. In five studies, researchers quantified exposure to cigarette smoke based on 'pack-years', which is determined by the number of packs of cigarettes smoked per day over the course of a year. A single pack-year is defined as the smoking of one pack of cigarettes per day per year. Thus, someone who smoked 1 pack of cigarettes per day over a course of 5-years would have a 5 pack-year smoking history. In other studies, smokers were categorized as ever, current, and past smokers, with each having varied classifications from study to study. For instance, Model (1985) defined a current smoker as someone who smoked 10 or more cigarettes per week during the last year and had smoked for 10 or more years. On the other hand, Ernster et al (1995) defined a current smoker as someone who had ever smoked 100 or more cigarettes, had ever smoked 1 or more cigarettes per day every day, and who had smoked within past 6 months.

Given that researchers used different methods for measuring wrinkles and smoking, findings from each study were varied; however, the overarching conclusion made from each study was similar: Smoking cigarettes was associated with a premature development of facial wrinkles. Specifically, smokers had a higher likelihood of developing wrinkles than former smokers, and an even higher likelihood of developing premature facial wrinkles than



Figure 1

An example of wrinkle scores based on Daniell's 6-point scale (Daniell, 1971). Each photograph indicates subject sex, age, wrinkle score, and smoking status. Note: SM = smoker, NS = nonsmoker.

never smokers. Perhaps the most interesting evidence of this conclusion is illustrated in Doshi, Hanneman, and Cooper's (2007) case study of 52-year-old identical twins. During their childhood and adulthood, the twins lived in the same locations and had similar sun exposure. Moreover, the twins had similar body mass index, skin care regimens, and medical histories. However, one twin had a 52 pack-year smoking history while the other twin did

not. The case study's researchers concluded that smoking was the variable responsible for the major difference in the twin's facial wrinkles (Doshi, Hanneman, & Cooper). In four studies, there is **some indication of a dose-response relationship**, as the studies revealed that smokers with higher pack-year histories of smoking had more wrinkles than those with lower pack-years. Overall, smoking had an effect on facial wrinkling in **both males and females**. With

Table 2

Daniell's 6-Point Wrinkle Scale

Grade	Skin Appearance
I	Essentially un wrinkled. Two or three shallow wrinkles usually less than 1½ cm in length may be present in each crow's-foot area.
II	Several wrinkles, each of which may be 3 cm long. The number of significant wrinkles on each side may be between two and six.
III	Several prominent wrinkles on each side, 3 to 4 cm long. Many smaller wrinkles may be present as well. Increased wrinkling may be present in the forehead skin, but little wrinkling in the cheek areas.
IV	Wrinkles extend from the crow's-foot area superiorly and inferiorly, usually 5 cm or more. If wrinkles are of unusual depth, they may be 4 cm long. Wrinkles extend over the cheek areas (zygomatic ridge). Men in this grade frequently exhibit prominent wrinkling of forehead and posterior nuchal region.
V	Wrinkles extend from the crow's-foot area and are prominent over the cheeks and forehead.
VI	Profound wrinkling extending over most of the face.

the exception of Black participants, research suggests that smoking had an effect on facial wrinkles of those from various races.

Discussion

The literature in this review indicates that smoking is indeed associated with the development of facial wrinkles. The majority of the studies used a convenience sampling strategy; however, the findings for the two studies with a random sampling strategy and the case study had similar findings. Even though the methods used to measure facial wrinkling and smoking status varied across studies, the overall finding of smoking's association with increased likelihood of facial wrinkling was consistent.

This literature review has practical implications for smoking cessation professionals. In terms of staying abreast of the research regarding smoking's association with facial wrinkles, cessation professionals may refer themselves and other professionals to this review as a practical reference about smoking and facial wrinkles. However, it is important to note that due to the inconsistent measures used by researchers, cessation professionals should be wary of making definite statements to clients about the degree of wrinkling that could take place due to smoking. Instead, cessation professionals would be more accurate by simply stating to clients that **the risk of developing wrinkles is enhanced for smokers.**

The authors acknowledge limitations to the methods used in conducting this literature review. First, it is possible that the search terms used in this review did not locate all articles concerning smoking and facial wrinkles. As such, conclusions made in this review may not represent the entirety of all published research on this topic. Second, excluding articles that were not peer reviewed may have disregarded important reports, theses, or dissertations that may have investigated smoking and facial wrinkles; however, this limitation is justified by the review's purpose to provide a snapshot of scientifically rigorous information on this subject.

References

- Aizen, E., & Gilhar, A. (2001). Smoking effect on skin wrinkling in the aged population. *International Journal of Dermatology, 40*, 431–433.
- Allen, H.B., Johnson, B.L., & Diamond, S.M. (1973). Smokers' wrinkles? *Journal of the American Medical Association, 225*(9), 1067–1069.
- Castelo-Branco, C., Figueras, F., de Osaba, M.J.M., & Vanrell, J.A. (1998). Facial wrinkling in postmenopausal women: Effects of smoking status and hormone replacement therapy. *Maturitas, 29*(1), 75–86.
- Chung, J.H., Lee, S.H., Youn, C.S., Park, B.J., Kim, K.H., Park, K.C., Cho, K.H., & Eun, H.C. (2001). Cutaneous photo-damage in Koreans: Influence of sex, sun exposure, smoking, and skin color. *Archives of Dermatology, 137*(8), 1043–1051.
- Daniell, H.W. (1971). Smoker's wrinkles: A study in the epidemiology of 'crow's feet'. *Annals of Internal Medicine, 75*, 873–880.
- Demierre, M., Brooks, D., Koh, H.K., & Geller, A.C. (1999). Public knowledge, awareness, and perceptions of the association between skin aging and smoking. *Journal of the American Academy of Dermatology, 41*(1), 27–30.
- Doshi, D.N., Hanneman, K.K., & Cooper, K.D. (2007). Smoking and skin aging in identical twins. *Archives of Dermatology, 143*, 1543–1546.
- Ernster, V.L., Grady, D., Miike, R., Black, D., Selby, J., & Kerlikowske, K. (1995). Facial wrinkling in men and women, by smoking status. *American Journal of Public Health, 85*(1), 78–82.
- Frances, C. (1998). Smokers' wrinkles: Epidemiological and pathogenic considerations. *Clinics in Dermatology, 16*, 565–570.
- Grogan, S., Flett, K., Clark-Carter, D., Gough, B., Davey, R., Richardson, D., & Rajaratnam, G. (2010). Women smokers' experiences of an age-appearance anti-smoking intervention: A qualitative study. *British Journal of Health Psychology, 16*(4), 675–689. doi:10.1348/2044-8287.002006
- Grogan, S., Flett, K., Clark-Carter, D., Conner, M., Davey, R., Richardson, D., & Rajaratnam, G. (2011). A randomized controlled trial of an appearance-related smoking in-

- tervention. *Health Psychology*, 6, 805–809. doi: 10.1037/a0024745
- Hysert, P.E., Mirand, A.L., Giovino, G.A., Cummings, K.M., & Kuo, C.L. (2003). At face value: Age progression software provides personalised demonstration of the effects of smoking on appearance. *Tobacco Control*, 12, 238.
- Ippen, M., & Ippen, H. (1965). Approaches to a prophylaxis of skin aging. *Journal of the Society of Cosmetic Chemists*, 16, 305–308.
- Kadunce, D.P., Burr, R., Gress, R., Kanner, R., Lyon, J.L., & Zone, J.J. (1991). Cigarette smoking: Risk factor for premature facial wrinkling. *Annals of Internal Medicine*, 114(10), 840–844.
- Koh, J.S., Kang, H., Choi, S.W., & Kim, H.O. (2002). Cigarette smoking and premature facial wrinkling Cigarette smoking associated with premature facial wrinkling: image analysis of facial skin replicas. *International Journal of Dermatology*, 41, 21–27.
- Leung, W.-C., & Harvey, I. (2002). Is skin ageing in the elderly caused by sun exposure or smoking? *British Journal of Dermatology*, 147(6), 1187–1191.
- Muizzuddin, N., Marenus, K., Vallon, P., & Maes, D. (1997). Effect of cigarette smoke on skin. *Journal of the Society of Cosmetic Chemists*, 48, 235–242.
- Model, D. (1985). Smoker's face: An underrated clinical sign? *British Medical Journal*, 291(6511), 1760–1762.
- Morita, A. (2006). Tobacco smoke and skin aging. In B.B. Halliwell & H.E. Poulsen (Eds.), *Cigarette smoke and oxidative stress* (pp. 379–385). Berlin: Springer.
- O'Hare, P.M., Fleischer, A.B. Jr., D'Agostino, R.B. Jr., Feldman, S.R., Hinds, M.A., Rassetta, S.A., McMichael, A.J., & Williford, P.M. (1999). Tobacco smoking contributes little to facial wrinkling. *Journal of the European Academy of Dermatology and Venereology*, 12(2), 133–139.
- Raduan, A.P.P., Luiz, R.R., & Manela-Azulay, M. (2008). Association between smoking and cutaneous ageing in a Brazilian population. *Journal of the European Academy of Dermatology and Venereology*, 22(11), 1312–1318.
- Schane, R.E., Ling, P.M., & Glantz, S.A. (2010). Health effects of light and intermittent smoking: A review. *Circulation*, 121, 1518–1522.
- Schnohr, P., Lange, J., Nyboe, M., Appleyard, M., & Jensen, G. (1991). Does smoking increase the degree of wrinkles on the face? The Copenhagen City Heart Study, *Ugeskr Laeger*, 153, 660–662.
- U.S. Department of Health and Human Services. (2004). *The health consequences of smoking: A report of the Surgeon General*. Atlanta: Author.
- Yin, L., Morita, A., & Tsuji, T. (2001). Skin aging induced by ultraviolet exposure and tobacco smoking: Evidence from epidemiological and molecular studies. *Photodermatology, Photoimmunology, & Photomedicine*, 17, 178–183.
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