Evaluation of facial aging related to cigarette smoking*

*Avaliação do envelhecimento facial relacionado ao tabagismo**

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Abstract: BACKGROUND - Cigarette smoking is a risk factor for several chronic conditions, such as cardiovascular and lung diseases, and skin aging.

OBJECTIVE - To compare the facial skin of smokers and nonsmokers.

METHODS - The survey included 77 patients aged 40-60 years and excluded those who had been submitted to esthetic facial treatment, who had been exposed to sun over 2 hours/day and who were alcoholic. There were 34 smokers and 43 nonsmokers. The skin alterations were evaluated and classified according to Model (smoker's face). The patients were assessed considering sex, race, age and pack-years of smoking.

RESULTS - We compared the total score of smoker's face in the two groups: smokers and nonsmokers, the latter had less alterations of the skin (p=0.021). There were significant statistical differences as to age (p=0.004) race (p<0.01). No differences were observed regarding sex and pack-years of smoking. A multivariate analysis demonstrated that cigarette smoking (odds ratio (OR)=3.49), race (OR=8.10) and age (OR=1.21) were independent factors for facial aging.

CONCLUSION - Cigarette smoking is an independent risk factor for facial aging. This finding could be useful in antismoking campaigns, especially those more interested in appearance than in internal damage.

Keywords: Face; Skin aging; Smoking; Tobacco

Resumo: *FUNDAMENTOS – O tabagismo é responsável por diversas doenças crônicas e pelo envelhecimento da pele.*

OBJETIVO – Comparar a pele facial de fumantes e não fumantes.

MÉTODOS – Foram avaliados 77 pacientes, 43 não tabagistas e 34 tabagistas, entre 40 e 60 anos, excluídos aqueles com exposição solar excessiva, etilistas e submetidos a tratamento estético da face. As alterações faciais foram avaliadas com base em escore de características da pele da face descrita por Model (fácies de tabagismo). Os indivíduos tabagistas e não tabagistas foram avaliados de acordo com o tempo e a quantidade de cigarros fumados, o sexo, a cor da pele e a idade.

RESULTADOS – A comparação quanto ao escore da fácies de tabagismo evidenciou que o grupo tabagista apresentou maior escore que o grupo não tabagista (p=0,021). Foram observadas diferenças significativas de escore na comparação entre as faixas etárias (p=0,004) e a cor (p <0,01). Em relação à quantidade de cigarros fumados e o tempo desse hábito de acordo com sexo não houve diferenças de escore. A análise multivariada das variáveis, evidenciou que o tabagismo, Odds Ratio (OR) = 3,49, a cor da pele (OR=8,10) e a idade (OR=1,21) são fatores independentes para o envelhecimento facial.

CONCLUSÃO – O tabagismo é fator de risco independente para o envelhecimento cutâneo. Esse achado confirma os efeitos cutâneos nocivos do cigarro, constituindo-se em mais um argumento na luta contra o tabagismo.

Palavras-chave: Envelhecimento da pele; Face; Fumo; Tabagismo

INTRODUCTION

Currently, one third of the world population older than 15 years of age is smoker (1:5 inhabitants of all ages), which corresponds to 1.2 billion people. As a consequence, 500 million people will die, half of which are younger than 20 years of age today.[1]

More than 75% of the deaths from lung cancer and chronic obstructive pulmonary diseases are directly attributed to smoking, which is also related to the etiology of other neoplams (stomach, esophagus, and bladder), and cardiovascular diseases.[2]

Smoking also causes skin alterations. However, the pathophysiologic mechanisms for these alter-

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ations are complex.

Cigarette smoke contains more than 4000 toxic substances, but nicotine is the most harmful compound. It is responsible for vasoconstriction that results in decreased blood flow, but this mechanism remains unknown. However, nicotine is believed to stimulate vasopressin. Additionally, cigarette acts on the sympathetic nervous system which also causes vasoconstriction. These factors together generate a significant tissue hypoxia, that is, a single cigarette results in skin vasoconstriction for more than 90 minutes. Chronic tissue ischemia results in damage to the elastic fibers and reduction in collagen synthesis.[3]

Other studies show that leukocyte stimulation by tobacco components results in the release of superoxide ions. This release of free radicals may cause tissue damage directly through lipid peroxidation or indirectly through the inactivation of enzymes, such as the α-1-proteinase inhibitor that, in normal circumstances, would protect tissues from the proteolytic action. These free radicals are usually inactivated by retinol, betacaroten, and tocoferol. However, serum and skin levels of these substances are low in smokers.[4,5] In addition, smoking leads to an increase in platelet aggregation, reduction in prostacyclin formation, and increase in blood viscosity and plasma activity of elastase. This increased activity of elastase causes a defective formation of elastin, resulting in a thicker, more fragmented skin.

Finally, cigarette smoking causes an increase in estradiol hydroxylation on the skin leading to a hypoestrogenic state in women, which can be associated with a dry atrophic skin, and worsened skin appearance.[4,5]

In 1985, Model[6] defined clinical criteria for the "smoker's face": a) prominent wrinkles; b) prominent bony contours; c) atrophic grey skin; d) skin plethora. The author considered that one single criterion would be enough to characterize such face.

Since skin alterations resulting from smoking are little studied and disseminated, the authors decided to conduct a comparative study between smokers and non-smokers facial skin.

MATERIAL AND METHODS

Patients treated at the Dermatology, Pneumology and Internal Medicine outpatient clinics of the Department of Medicine of Irmandade da Santa Casa de Misericórdia de São Paulo were evaluated. Patients with age ranging from 40 to 60 years, non-alcohol drinkers, without history of excessive sun exposure (less than two hours a day), and those not undergoing facial cosmetic treatment were selected for the study. Each patient was evaluated by two observers who had been trained prior to the beginning of the clinical evaluation.

The patients were evaluated in relation to age, sex, skin color (white, non-white and yellow), and cigarette consumption (greater than or equal to 10 years/pack and lower than 10 years/pack). The year/pack unit is used to define the number of packs smoked during a determined length of time, and corresponds to one pack of cigarettes smoked per day for one year. Therefore, if a person smoked one pack of cigarettes per day for 10 years or two packs per day for five years, he/she will have smoked 10 years/pack.

All patients were classified according to facial skin alterations possibly determined by smoking, which characterize the "smoker's face"[6] ((Chart 1), and received a final score considering one point for each characteristic. Therefore, the maximum score that a patient could achieve was seven points. Patients who had no points or at least one score point were separated in one group, and those who had at least two points were separated in another group for the score analysis in relation to other variables. This cut-off point in relation to the score was decided according to total patient distribution: 53 patients (68.8%) had a score ≤ 1 (Table 1).

Statistical analysis

The classificatory variables (gender and color) in relation to the smoker and non-smoker groups are presented in tables containing the absolute (N) and relative (%) frequencies, and the chi-square test was used to analyze the association between them.

The Mann-Whitney test was used to analyze the score. The Student's t test was used to compare mean ages. A multivariate logistic regression model was adjusted for the score, classified in ≤ 1 and > 1. The p values < 0.05 were considered statistically significant.

RESULTS

A total of 77 patients with age ranging from 41 to 60 years (mean of 52.3), of which 49 were females

CHART 1: Smoker's face

Smoker's face	Characteristics
1	Expression lines around the lips
2	Lines on eye corners
3	Deep lines on cheeks
4	Numerous superficial lines on cheeks and mandibular region
5	Bone prominence and sagging of the cheeks
6	Skin atrophy
7	Grey complexion

Sources: Model B[6] e Daniell HW.[8]

Table 1: Distribuição dos pacientes em relação ao total do escore da face de tabagismo

Total score	Number of patients
0	37
1	16
2	6
3	13
4	3
5	1
6	1
7	0
Total	**77**

(63.6%) and 28 were males (36.4%) participated in the study. Thirty four individuals (44.2%) were in the smoker group, and 43 (55.8%) in the non-smoker group. Since the patients were not randomized, the chi-square test was used to compare the two groups as to sex, color, and age variables. With the results obtained we could observe that the characteristics of the individuals in the smoker and non-smoker groups were homogeneous in relation to the variables, thus allowing a reliable analysis (Table 2).

The comparison of smoker's face scores showed that the smoker group had higher scores than the non-smoker group, that is, individuals in the smoker group had more skin alterations with a statistically significant difference ($p = 0.021$). Significant differences in the scores were observed when the age ranges ($p = 0.004$) and color ($p < 0.01$) were compared, that is, the older the individuals with white skin, the more facial skin alterations they had. Regarding the number of cigarettes smoked and duration of smoking ($p = 0.374$) and gender ($p = 0.282$) no significant differences of scores were observed (Table 3). When the scores were classified into two groups – one with scores ≤ 1 e1 and the other with scores > 1, the same characteristics were observed in relation to smoking ($p=0.029$), skin color ($p = 0.001$) and age ($p < 0.01$) (Table 4).

The multivariate analysis of variables showed that smoking, skin color and age are independent factors in facial aging (Table 5). The probability of a white person to have a score > 1 is eight times higher than that of a non-white person, odds ratio (OR) = 8.102. Likewise, the probability of a smoker to have a score > 1 is 3.5 times higher than that of a non-smoker (OR = 3.499), and at each one-year increase in the age of individuals, their probability of a score > 1 increases by 20% (OR = 1.211) (Table 6).

Graph 1 shows that a smoker white individual has a higher probability of a score >1 when compared to a smoker non-white individual, as well as a non-smoker white individual when compared to a non-smoker non-white individual. For a cutoff point of 0.36 for the probability of a score > 1, the model sensitivity is 75%, and the specificity is 73.6%.

DISCUSSION

Skin tissue alterations caused by smoking are an issue that has been studied worldwide. Although literature is not very extensive, there is a consensus that smoking causes early facial aging. In 1965, Ippen and Ippen[7] defined "the smoker's skin" as pale, grey and wrinkled. In a group of women with age ranging from 35 to 84 years, they found this type of skin in 79% of smokers and in 19% of the non-smokers. In 1971, Daniell[8] showed that expression lines or wrinkles were more prominent and common among smokers in comparison with non-smokers in all ages, sexes, and even in groups with higher sun exposure. In 1985, Model[6] defined the clinical criteria for the "smoker's face": a) prominent wrinkles; b) prominent bone contours; c) atrophic grey skin, and d) plethoric skin. The author considered that one single criterion is enough to characterize the smoker's face. The evaluation of the patients of this study was based on this classification.

The characteristics of facial aging caused by smoking are quite significant and determined by alterations of the collagen fibers of the deep dermis,[5] and that is why the wrinkles are well marked.

Aging was more evident among smoker

Table 2: Characteristics of the smoker and non-smoker groups in relation to sex, color and age

		SMOKER				
Variable		**Yes**		**No**		**P**
Gender	F	20	59%	29	67%	0.435
	M	14	41%	14	33%	
Color	W	20	59%	22	51%	0.503
	NW	14	41%	21	49%	
Age	≤ 50 y	11	32%	17	40%	0.515
	> 50 y	23	68%	26	60%	

F = female; M = male; W = white; NW = non-white

TABLE 3: Characteristics of individuals in relation to score and variables: sex, age, skin color, smoker and non-smoker, and duration and number of cigarettes smoked (years/pack)

Variables		Mean	Standard Deviation	P
Gender	F	1.08	1.52	0.282
	M	1.32	1.33	
Age	≤ 50 y	0.60	1.20	0.004
	> 50 y	1.49	1.50	
Color	W	1.76	1.48	< 0.001
	NW	0.46	1.07	
Smoker	Y	1.61	1.63	0.021
	N	0.81	1.20	
Years/pack	< 10	1.21	1.31	0.374
	≥ 10	1.84	1.83	

F = female; M = male; W = white; NW = non-white; Y = yes; N = no

patients than among non-smokers, with a statistically significant difference (p = 0.029). We were able to verify that 79% of non-smokers presented none or one of the characteristics of the smoker's face versus 56% of smokers. Forty four percent of the smokers, in turn, showed two or more characteristics of the smoker's face versus 21% of the non-smokers.

Once facial aging due to smoking had been well characterized, we tried to determine whether other variables could have been significant among the patients.

Regarding sex, in the literature women are known to be more susceptible to aging related to cigarette smoking than men.[4,5] This could be due to the decrease of the female hormone in the skin, caused by nicotine. The present study, however, did not show this difference.

The same occurred when the duration of smoking and cigarette consumption were compared, that is, no significant difference of facial aging was observed between those who smoked more in relation to those who smoked less. These two observations contradict the literature. However, it is possible that a larger case series could show other evidences.

We could observe, with the multivariate analysis, that smoking has a significant effect on the face score regardless of age and skin color, that is, a smoker with the same age and skin color as a non-smoker will show a more evident facial aging. The probability of a smoker to present a score > 1 is 3.5 times higher than that of a non-smoker.

An interesting fact is that white patients obtained a higher aging score than non-white patients. The literature points out a synergistic effect

TABLE 4: Distribution of patients' smoker's face score in relation to sex, color, age, and smoking habit

		SCORE		
		0-1	>1	P
Sex*	F	36 - 73%	13 - 27%	0.245
	M	17 - 61%	11 - 39%	
Color*	W	21 - 50%	21 - 50%	0.001
	NW	32 - 91%	3 - 9%	
Years/pack*	< 10	9 - 64%	5 - 36%	0.503
	≥ 10	10 - 53%	9 - 47%	
Smoking*	Y	19 - 56%	15 - 44%	0.029
	N	34 - 79%	9 - 21%	
Age**	50.69 ± 5		55.83 ± 4.93	<0.001

F = female; M = male; W = white; NW = non-white;
Y = yes; N = no; * Chi-square test; ** Student's *t* test

Table 5: Logistic regression model for score > 1

Variable	Parameter estimated	Standard Error	P
Intercept	-13.062	3.876	0.0008
Smoking (Y/N)	1.253	0.631	0.0473
Color (W/NW)	2.092	0.736	0.0044
Age	0.192	0.069	0.0056

Y = yes; N= no; W = white; NW = non-white

Table 6: Odds ratio and respective confidence intervals of factors predictive of score > 1

Variable	Odds ratio	Confidence interval (95%)
Smoking	3.499	1.015 – 12.060
Color	8.102	1.917 – 34.245
Age (age unit)	1.211	1.058 – 1.388

of the sun in relation to aging related to cigarette smoking. It is possible that this result shows that the skin color of non-white smokers may attenuate the aging appearance determined by smoking because of their natural sun protection. The probability of a white person to have a score> 1 is eight times higher than that of a non-white person.

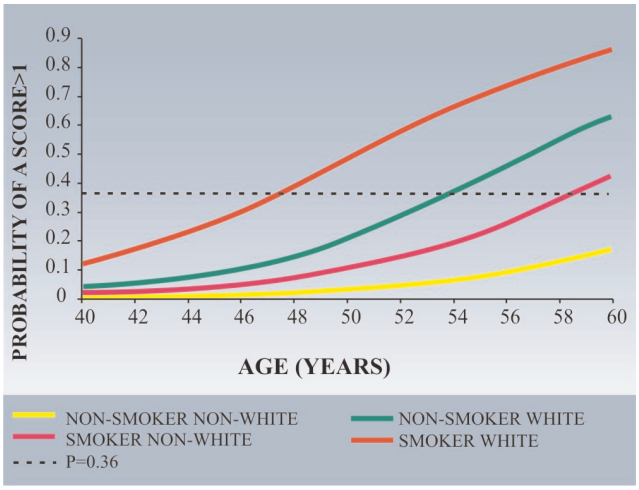
As expected, age is also an independent factor in skin aging, and for every one-year increase in the age of individuals, their probability of a score > 1 increases by 20% (OR = 1.211).

This study shows that color, smoking and age are independent variables for facial aging. Therefore, as depicted in graph 1, the probability of a smoker white individual to have a score > 1 is higher than that of a smoker non-white individual, as well as that of a non-smoker white individual in comparison with a non-smoker non-white individual, the latter being the group the most protected against aging according to age among all these groups.

CONCLUSION

The results of this study corroborate the skin effects of cigarette smoking, and are one more argument in the fight against smoking that could become an effective motivation for those who are more concerned about looks than about health hazards of smoking. ❑

Graph 1: Probability of a score > 1 in relation to age in the non-smoker white, non-smoker non-white, smoker white, and smoker non-white groups



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