

Evaluation of facial expression recognition in patients with facial melasma: a cross-sectional study

Avaliação do reconhecimento das expressões faciais em pacientes com melasma facial: um estudo transversal

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ABSTRACT

Introduction: Melasma is frequent among women, and it is associated with a significant psychosocial impact. The facial expressions recognition is a cognitive process directly related to our emotional and psychosocial status.

Objectives: This study evaluates the melasma patients' ability and healthy controls in identifying facial expressions reflecting six main emotions.

Methods: This is a cross-sectional study, including 24 melasma patients and 24 healthy controls, matched for age. We collected demographic data, dermatology life quality index (DLQI), Hospital Anxiety and Depression Scale (HADS), and Social Phobia Inventory (SPIN). Also, we conducted a computerized facial emotion recognition test using 56 images.

Results: The participants had a mean age of 39.8 (sd: 8.1), and the melasma patients reported a median of 84 months (p25-p75: 48-144) duration of the dermatosis and a median DLQI of 6 (2-10). Patients with melasma presented higher anxiety scores (9.4 [4] x 6.7 [4.3]; $p=0.03$) and showed higher accuracy in identifying emotions due to their greater success in recognizing fear (35 [13-52] x 13 [3-25]; $p=0.03$). The non-biased right answers' difference remained significant after multivariate analysis adjusted for the anxiety scores ($p<0.01$).

Conclusions: Women with melasma presented a higher accuracy in recognizing facial expressions of fear, suggesting differentiated brain processing of emotions in this population.

Keywords: Anxiety; Emotions; Melanosis

RESUMO

Introdução: O melasma é frequente entre mulheres, estando associado a significativo impacto psicossocial. O reconhecimento das emoções faciais é um processo cognitivo envolvido com o nosso status emocional e psicossocial.

Objetivos: Avaliamos a habilidade de portadoras de melasma e controles hígidos em identificar expressões faciais das seis principais emoções.

Métodos: Estudo transversal, com 24 portadoras de melasma e 24 controles, pareadas por idade. Foram coletados dados demográficos, qualidade de vida em Dermatologia (DLQI), escore hospitalar de ansiedade e depressão (HADS), fobia social (SPIN), e foi realizado um teste de reconhecimento de emoções faciais por computador com 56 imagens.

Resultados: As participantes tiveram idade média de 39,8 (dp: 8,1) anos, e as portadoras de melasma relatavam uma mediana de 84 (p25-p75: 48-144) meses de duração da dermatose e um DLQI mediano de 6 (2-10). As portadoras de melasma apresentaram maior habilidade na identificação das emoções, devido a maiores acertos no reconhecimento do medo (35 [13-52] x 13 [3-25]; $p=0,03$), e maiores escores de ansiedade (9,4 [4] x 6,7 [4,3]; $p=0,03$). A diferença nos acertos não enviesados manteve-se significativa após análise multivariada ajustada pelos escores de ansiedade ($p<0,01$).

Conclusões: Mulheres portadoras de melasma apresentaram maior habilidade no reconhecimento da expressão facial de medo.

Palavras-chave: Ansiedade; Emoções manifestas; Melanose

Original Articles

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INTRODUCTION

Melasma is a frequent dyschromia among women and is associated with significant psychosocial impact on patients' quality of life. It usually begins between the third and fourth decades of life in people with mixed color skin. Despite being associated with chronic sun exposure, genetic factors, and sex hormones, its etiopathogenesis is not fully understood. Changes such as solar elastosis, dermal inflammatory process, and basement membrane damage found in skin with melasma, suggest the role of inflammatory cells such as mast cells and photoaging in the disease's etiopathogenesis.¹⁻³

Among the psychological changes related to melasma, there has been a greater propensity to stress and anxiety, and emotional processing may be altered in this population. Also, quality of life, understood as a general perception of well-being involving different aspects of the individual's life, seems to be significantly affected in melasma patients.^{4,5}

Recognition of facial emotions is a cognitive process directly involved with our emotional and psychosocial status. Emotional changes may be related to accuracy in recognizing the different emotions expressed by others.⁶⁻⁸ Recognition and interpretation of emotional facial expressions play a crucial role in adapting to the environment and facilitating social interaction.⁹

Since 1990, visual affective stimuli have been used in research on emotions, since image visualization has privileged access to the semantic network where affective information is stored.¹⁰

In the present study, we assessed the melasma patients' ability and healthy controls to identify facial expressions of the six main emotions (fear, anger, joy, sadness, surprise, and disgust). We sought to verify if there is any differentiation in this cognitive capacity between groups and some correlation with questionnaires already translated and validated in Brazilian Portuguese about quality of life (DLQI), symptoms of anxiety or depression through the Hospital Anxiety and Depression Score (HADS), and social phobia through the Social Phobia Inventory (SPIN). These characteristics can affect the facial recognition ability of emotions.

METHODS

A cross-sectional study was conducted with 24 melasma patients and 24 previously age-matched controls without dermatological complaints. The study included women aged 18 to 60 years, recruited from the between January and October 2016, with no difficulties in understanding or communication, no decreased visual acuity, and no accompanying psychiatric comorbidities, according to the participant's report, after signing the informed consent form.

The institution's ethics committee approved the study.

Demographic data were collected, and the Dermatology Life Quality Index (DLQI), Hospital Anxiety and Depression Scale (HADS), Social Phobia Inventory (SPIN) questionnaires, all validated in Portuguese, were applied. Also, we used an emotion recognition test through a computer-assisted facial

image. The test randomly displayed, on a 16-inch monitor, eight copies of each illustrated emotion (anger, disgust, joy, neutral, sadness, surprise, and fear) totaling 56 images.¹¹⁻¹⁶ Each image was preceded by a 3 seconds countdown and presented for 0.5 seconds before being hidden, in an adaptation of Calvo's method (2008).¹⁷ The interviewee had free time to indicate which emotion she had recognized after each photo presented, and the image could not be shown again. (Figure 1) The 56 open access facial expression images were obtained from the Karolinska Institute (Solnavägen, Solna, Sweden).¹⁸

The HADS questionnaire was used because it is an open-access tool, often used in research on anxiety in medical studies, which reported higher anxiety levels in women with melasma. The report of interference of this feature with the ability to recognize emotions justifies the analysis of social phobia through SPIN, a tool validated for Portuguese.¹⁹

Continuous variables were analyzed between the case and control groups by the Student-parametric t-test or the Mann-Whitney non-parametric test according to the normality of the distributions assessed by the Shapiro-Wilk test.²⁰ Categorical variables were compared by the chi-square or Fisher's exact when the lowest expected value was less than 6. The ability to recognize emotions was assessed by the bias hit index adjusted by a mixed generalized linear model with gamma distribu-

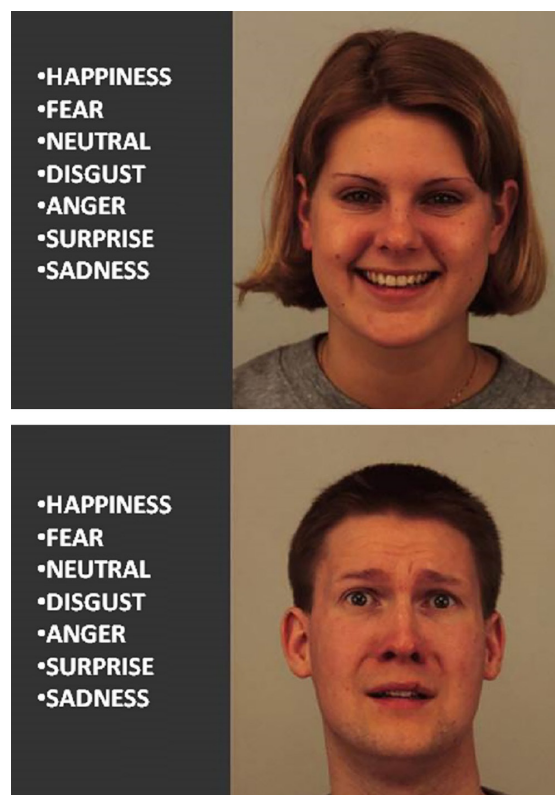


FIGURE 1: Examples of facial expressions of happiness and fear used in the facial emotion recognition test (8 examples x 7 emotions = 56 images per test).

tion and post-hoc significance adjusted by the Sidak sequential method.^{18,21,22}

RESULTS

Table 1 compares the demographic and psychometric data between the groups, where there are higher HADS anxiety scores among melasma patients. Patients with melasma had a median of 84 (p25-p75: 48-144) months of disease duration and a median DLQI of 6 (2-10). There was no difference between the groups regarding marital status, income, education or social phobia scores and depression.

Women with melasma had a greater ability to identify emotions due to better recognition of fear expression (Figure 2). Multivariate analysis, adjusted for HADS anxiety values, confirmed this finding, with better performance only for fear expression ($p < 0.01$). The difference between melasma patients and controls in fear recognition was significant for those with HADS anxiety above 7 (36 [13-50] x 8 [3-16]; $p < 0.01$), but not for those with lower HADS anxiety levels (22 [4-33] x 13 [6-25]; $p = 0.46$).

There was no correlation between fear recognition scores and HADS anxiety (Rho = 0.08; $p = 0.58$) or DLQI (Rho = 0.23; $p = 0.29$) values.

DISCUSSION

Patients with melasma presented correct identification of facial expression of fear, as well as higher anxiety scores. The significance of the correctness in recognizing emotions was adjusted by Sidak's sequential method to decrease the chance of such findings occurring at random due to multiple comparisons. Also, the groups were age-matched and had similar education, income, marital status, and depression and social phobia scores.

Previous studies have already identified a possible association between stress and anxiety with melasma, which may be related to facial recognition of emotions. In 2008, a study found that 26.3% of women reported melasma stress as an aggravating factor of the disease, and 28.6% had a previous psychiatric diagnosis between depression and anxiety.⁵ Similarly, Bimal et al. (2017) identified high anxiety scores in 36.6% of melasma patients in northern India.²³

Wolf et al. (1991) reported two melasma cases that manifested two to three months after acute stressful events (death of family members), with no other obvious risk factors.²⁴ Finally, Handel et al. (2014) found higher levels of anxiety and increased consumption of anxiolytics or antidepressants in women with melasma.⁴

TABLE 1: DEMOGRAPHIC AND PSYCHOMETRIC FEATURES AND ACCURACY ON FACIAL EMOTION RECOGNITION TEST FOR THE STUDY GROUPS.

Features	Melasma	Controls	OR (CI 95%)	p
Age*	39.5 (7.5)	40.1 (8.7)	-	0.81
Married / civil union**	15 (62.5)	16 (66.7)	0.83 (0.25 to 2.72)	0.77
Income up to 3 minimum wages**	18 (75)	17 (70.8)	1.23 (0.34 to 4.42)	0.76
Complete basic education**	10 (41.7)	12 (50)	0.71 (0.22 to 2.23)	0.56
Regular study years†	8.5 [4-11]	11 [5-11]	-	0.25
Spin†	15.5 [10-25]	14 [7-25]	-	0.57
HADS-depression†	7 [6-8]	6.5 [4-9]	-	0.45
HADS-depression ≥ 8**	9 (38)	9 (38)	-	0.99
HADS-anxiety*	9.4 (4)	6.7 (4.3)	-	0.03
HADS-anxiety ≥ 8**	18 (75)	11 (46)	-	0.04
Total hits (%)†	77 [70-80]	69 [58-76]	-	0.04
Accuracy by emotion ‡				
Anger†	59 [44-68]	50 [28-64]	-	0.33
Disgust†	75 [45-76]	64 [52-76]	-	0.72
Happiness†	100 [88-100]	97 [88-100]	-	0.49
Neutral†	70 [62-80]	61 [38-89]	-	0.84
Sadness†	57 [28-75]	48 [22-57]	-	0.27
Surprise†	59 [44-67]	45 [36-53]	-	0.24
Fear†	34 [13-50]	13 [3-25]	-	0.03

* Mean (standard deviation); Student's t test; ** n (%); Fisher's exact test; † Median [1 quartile - 3 quartile]; Mann-Whitney's test.

‡ Significance corrected by the sequential Sidak method; unbiased scores: 100 * hits2 / (8 * total use of the option).

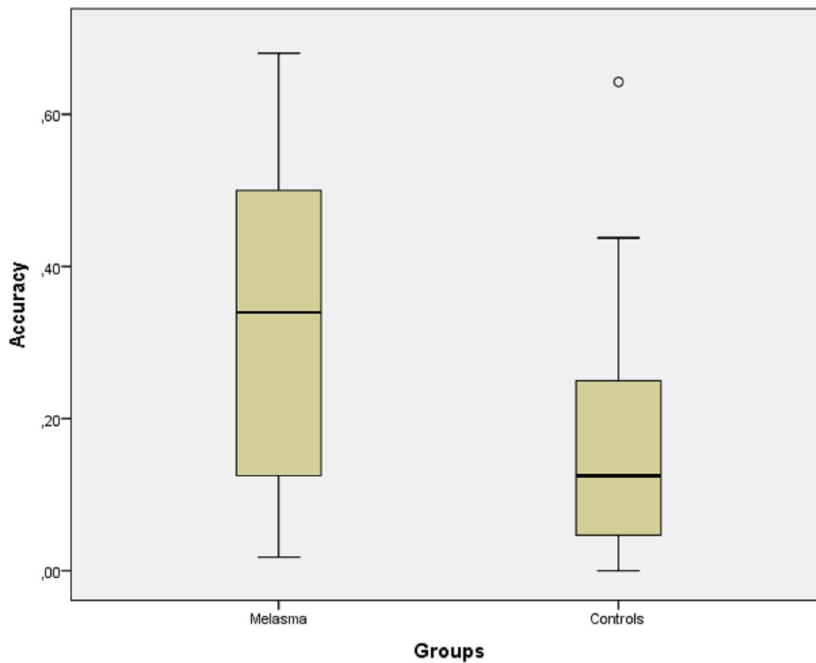


FIGURE 2: Accuracy (unbiased hits) on the recognition of fear facial expression (Boxplot).

In addition to reports of the association between stress and anxiety with melasma, the symmetrical facial feature, regularly involving areas innervated by the trigeminal nerve, suggests that the nervous system may play a significant role in the pathophysiology of the disease. In this sense, Bak et al. (2009) identified increased expression of nerve growth factor (NGF) receptors and neural endopeptidase in melasma lesions compared to normal adjacent skin.²⁵

Significant evidence indicates that stress-associated events in animal and human models are associated with changes in NGF production or action. Also, NGF may promote the remodeling of damaged tissues following acute or chronic stressful events.²⁶

Peters et al. (2004) found in animal studies that NGF release is a major step in stress-induced capillary growth and fall, as well as the activation of mast cells and antigen-presenting cells in the skin.²⁷

The present study's findings indicate that melasma patients have a greater ability to recognize fear facial expressions. Furthermore, Surcinelli (2006) found that people with high anxiety levels have a greater ability to recognize fear in facial expressions.⁶ Thus, our findings corroborate the observation of a higher anxiety level in women with melasma according to Handel et al.⁴

Different psychosocial and socioeconomic factors may influence facial recognition of emotions. However, considering age matching and the absence of significant differences regarding marital status, income, and education level between the two groups in the present sample, the findings suggest the existence of a significant relationship between melasma, anxiety, and the ability to recognize facial emotions.

Recognition of fear facial expression is particularly associated with the amygdala's function, with bilateral lesions in these parts of the brain leading to prominent impairment of this ability.²⁸ Also, Stein et al. (2007) found that people prone to anxiety show greater activation of the amygdala and insula during brain processing of emotions.²⁹

By analyzing subgroups according to HADS anxiety levels, we found that the difference in recognition of fear expression was significant only in participants with higher anxiety scores, suggesting that emotional processing of anxiety may differ between women with and without melasma, leading to different impacts on facial recognition of emotions.

The observed results suggest that melasma patients may present a greater amygdala activity and anxiety propensity; however, causal relationships between this observation and skin changes cannot be concluded in the present study. The trigeminal nerve may be the connection between skin and psychological changes. Effective treatment of persistent generalized anxiety through percutaneous trigeminal electrical stimulation has been reported, indicating the propagation of facial stimuli to nuclei involved in the processing of emotions, such as the amygdala and insula, through extensive connections to the trigeminal nuclei of the brain stem.³⁰⁻³² Trigeminal stimuli related to amygdala activity could influence inflammatory and pigmentary changes observed in melasma.

The present study has limitations because it is monocentric and only includes patients from the public healthcare system, which may impair the results' external validity. On the other hand, the results corroborate previous findings from the literature on the subject.

CONCLUSION

We can conclude that the women with melasma evaluated presented a better performance in recognizing the facial expression of fear, especially among those with higher anxiety levels, suggesting possible connections between the disease's

pathophysiology and characteristics of brain processing of emotions. Although consistent with the literature, this finding should be extended to different groups and centers to verify their external validity. ●

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