Research Article

Recognition of Emotional Facial Expressions and Alexithymia in Patients with Chronic Facial Pain

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Abstract

Objectives: Alexithymia, conceived as difficulties to identify emotions, is said to be related with several pain syndromes. This study examined the recognition of facially expressed emotions and its relation to alexithymia in subjects with chronic facial pain.

Methods: A total of 62 subjects were recruited, with n=20 patients with chronic facial pain and n=42 healthy controls. All subjects were tested for the recognition of facially expressed emotions (Facially Expressed Emotion Labelling Test (FEEL test). The Toronto Alexithymia Scale (TAS-26) was used for the diagnosis of alexithymia.

Results: Patients with chronic facial pain performed worse than controls at the FEEL task (p<.001) and showed higher total TAS scores (p<.001). This indicates the presence of alexithymia and facial emotion recognition deficits in the facial pain group.

Discussion: It was concluded from the results that both the recognition of facially expressed emotions, and the ability to identify and describe one's own feelings (TAS), are restricted in chronic orofacial pain patients. This relationship is particularly important in the treatment of chronic facial pain, indicating that it should become part of the treatment in addition to the therapeutic key issues, to influence the quality of life of the affected patients positively.

INTRODUCTION

Alexithymia is characterised by a lack of emotional consciousness and is often stated in connection with chronic pain syndromes and therefore, it seems to be an important factor in the development of a chronic facial pain syndrome [1-4]. It has been reported that alexithymia is associated with poor recognition of others's facial expressions [5-7].Causes of alexithymia are unknown. Presumptions go towards neurobiological causes such an interruption of the connection between the limbic system and parts of the thalamus [8].

Patients who are affected by chronic facial pain present a special challenge for all medical disciplines in pain community [1,9,10]. Compared to other chronic pain disorders, a high psychological and symbolic significance is assigned to the facial region as pain localization. Self-confidence and interpersonal relations can be influenced by chronic pain [11].

Viewing facial expressions of pain can activate cortical areas which are responsible for the direct experience of pain [12]. Emotion-generating regions of the brain are mutually connected among themselves, as well as with neuro modulatory systems and with other brain regions which are involved in sensory, motor and cognitive functions [13]. Interestingly, Neal et al. [14] found that patients with facial Botox treatments could not properly assess the facial expressions of other persons due to their own reduced muscular contractions. The inability to express feelings with mimics also disturbs the awareness of one's own emotions [14,15]. How much this disorder in recognition of emotional expressions influences life and thinking of the affected persons is still unexplored.

Human beings need a facial motor system which is correctly innervated afferently and efferently [11,16]. During a long term peripheral (facial) nociception like odontalgia, post-face traumas ,painful TMD's, this may change brainstem and cerebral neural circuits which may lead to (facial)motor activity changes [17]. These changes are not only seen in the head-face...but also in

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pain-inhibiting pain-inhibiting posture and persistent pain in other body parts are not uncommon [1,16].

Chronic pain sufferers are often shown pain-related posture for fear of pain provocation. According to Neal et al. [14], a person recognizes the mimicry of another person only if he deciphers the perceived stimulus by the activation of his or her own muscles of the face. It is difficult to implement and recognize the mimicry of strangers due to the missing expression of one's own emotional state. So it is quite sensible to think that people with chronic facial pain avoid showing emotions and make fewer facial expressions than people without pain. Testing facial emotion recognition (FER) may be a reliable way to research emotional processing in patients with facial pain. Current research in the field of somatoform disorders shows that a reduction of negative emotions after states of high arousal can predict a reduction of pain [18]. Additionally, skills in the field of emotion regulation can predict aspects of handling with chronic pain [19]. The correlation between negative affect or even depressive disorders and somatoform disorders lead to the idea, that emotion regulation plays a crucial role in chronic pain [20,21]. Other clues can be derived from research in the field from tension headache. Patients with tension headache underrate negative emotions and the degree of stress. Traue and colleagues discuss that negative reinforcement plays a key role in the process. The suppression of expressivity helps to avoid negative consequences – instead patients get tension headache [22]. This inefficient strategy to tackle social stress may be transferable to patients with chronic facial pain.

In light of these facts, alexithymia could not only be a contributing factor but also an independent precursor in the development of chronic facial pain.

Our hypothesis is that people with chronic facial pain would perform worse than controls in identifying facially expressed emotions (FEEL-Test) and that this deficit would not only be explained by the presence of alexithymia.

MATERIALS AND METHODS

The participants

A total of 21 participants with chronic facial pain were recruited from our rehabilitation clinics in Germany. They needed to be aged between 18 and 65 years, have facial pain for a minimum of 12 months, and has to fit the Diagnostic Criteria for Temporo- mandibular Disorder (DV-TMD). Participants were required to report a score larger as 50 mm on the Coloured Analogue Scale (CAS)Participants were excluded if they had a change of permanent medications during the past six weeks as well as additional neurological histories or psychosomatic illness. One patient was excluded from participation based on psychosomatic conspicuousness. Controls (n=42) were age and gender matched and there were no outliers

Data collection procedure

The study participants were invited to the recruiting clinic. Prior to signing the informed consent, the subjects were informed about the study content and the study procedure. Any questions posed, were clarified. Subsequently, the diagnostic questionnaire

and the Toronto Alexithymia Scale (TAS) were completed in a quiet, well lit room. Each participant was instructed to make themselves comfortable sitting in front of the laptop. It took a total of 30 minutes per subject, to collect the data.

Questionnaires

Both groups completed a diagnostic questionnaire and the Coloured Analogue Scale (CAS) [23] pain rating prior to beginning the emotion recognition tasks and the Toronto Alexithymia Scale (TAS).

Coloured Analogue Scale (CAS)

The CAS is a pain intensity scale similar to the visual analogue scale VAS) that was designed especially for patients with headache of different age categories. The participant indicates the intensity of the complaints by marking the point on an increasingly colored line that best represents his or her symptoms. On the back, the marking line gives a score corresponding to the VAS 42)

Alexithymia (Toronto Alexithymia Scale 26)

Characteristics of Alexithymia were documented with the Toronto Alexithymia Scale 26(TAS -26) [15]. This subjective self-evaluation questionnaire allows for making a dependable determination about the characteristics of alexithymia [15, 24].The sum score of the TAS -26 determines the extent of alexithymia which is classified in three sub-scales. Therefore, it allows differentiating which of the three characteristic aspects of alexithymia (*difficulty in identifying emotions* (scale 1), *difficulties in describing emotions (*scale 2), *externally oriented thinking style* (scale 3) dominate. The German version was used which demonstrated satisfactory quality criteria (Cronbach's alpha =.67 to .84 [15]). The participants had to answer a total of 26 items on a five-point Likert scale and it took approximately five to ten minutes to complete. A participant is diagnosed with alexithymia when a score of 3.0and higher is recorded.

The TAS is used to collect various dimensions of alexithymia. It is divided into three sub-scales: *Scale 1* describes the difficulties in the identification of feelings. This refers to the identification of emotions in physical processes, and the understanding of physiological components of emotions. *Scale 2* describes the difficulty in the description of feelings. This refers to the physical expression of emotions, and includes the communicative / non-verbal aspect. A high value in this sub-scale indicates frequent problems in the interpersonal area of the affected patients [15]. Therefore, the inability to recognize emotions in facial expression is a partial aspect of alexithymia [25, 26]. *Scale 3* refers to the style of thinking with external focus. Subjects with high values in this dimension demonstrate a style of thinking that is concerned with "external" factual topics in a highly superficial manner and does not leave much leeway to the emotional "deeper" aspects of the social realm.

Emotion recognition

FEEL- Test: The computer-controlled Facially Expressed Emotion Labelling Test (FEEL-Test, version 3.2, 2008) of the Ulm University was used to measure the ability to recognize facially expressed basic emotions(facial emotion recognition FER) [27, 28]. Compared to many other testing procedures to recognize the

emotions, the FEEL test does not measure the self-assessment but the objective ability to recognize the six basic emotions in pictures of other faces.

Reliability for FEEL test has been previously established [27] by Kessler et al. The computer test shows coloured photographs of people of international origin which display the typical mimicry of facial expressions of the six basic emotions fear, sadness, anger, surprise, happiness, and disgust. The main test consists of 42 images (seven images for each emotion and 21 pictures per gender). The task is subdivided in six steps per image (Figure 1). A neutral facial expression was also included and viewed prior to each expression image. Responses were given using a 'mouse click' to one of the six boxes relating to the selected expression. Participants were then given a 4-6 second break before the next image was shown. Prior to testing, each participant was given a pretest with 6 images. We were not interested in their individual response times; only overall task time was recorded.

The maximum points that can be achieved is 42. The average total points healthy people achieved in this pilot study is 34.4 points [27].

Data collection and ethical approval

The study was conducted in accordance with the Helsinki guidelines and approved by the local ethics commission of the University of Applied Science Osnabrück (Code WiSo_BA_ELP_SS15_0/1)

Data analysis

Data was analyzed used SPSS 22.0. Because there was no normal distribution to refer to, the treatment groups were compared for significance with the non-parametric Mann-Whitney-U test. There were additional deviations in the individual results, so the correlations of the various test procedures were calculated with the Spearman correlation coefficient.

RESULTS

Participants

20 chronic facial pain participants (16 female) that met the in-exclusion criteria were included in the study. There were recruited forty-two healthy gender matched controls were also recruited in the chronic facial pain group, participants showed average pain duration of 106.3 (SD 83.70) months. See Table 1 for demographic data.

Toronto Alexithymia Scale (TAS)

The TAS value was significantly higher in the facial pain group (mean value 2.95 ± SD. 0.51; U=22, Z=-17.69, p= .001) than the healthy control group (mean value 2.57, 78±SD. 0.33) (Figure 2). 15 of 20 participants (13 female) had Alexithymia and none in the control group. The TAS evaluation with regard to gender distribution did not show any significant distinctions between males and females in both groups with regard to the total TAS value and all three sub-scales (p=.887).

Difficulties in identifying emotions (scale 1)

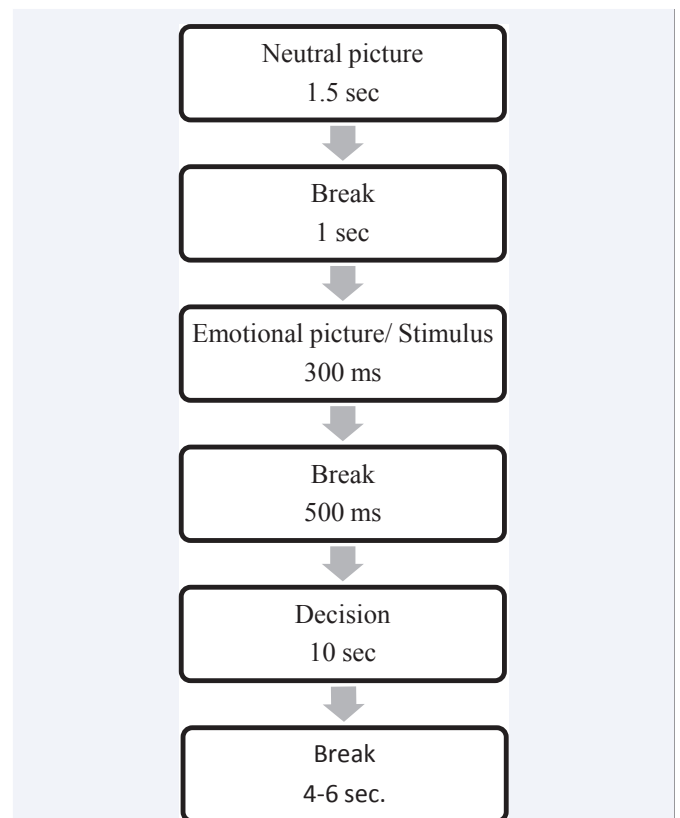If this value is increased, it describes difficulty in the

Neutral picture 1.5 sec	
Break 1 sec	
Emotional picture/ Stimulus 300 ms	
Break 500 ms	
Decision 10 sec	
Break 4-6 sec.	

Figure 1 A timeline showing the FEEL test's 6-step process. This was repeated for each of the six facial emotions.

Table 1: Mean ± standard deviation for age and pain rating (Coloured Analogue Scale) for both the chronic facial pain and control groups.

	Controls n=42	Chronic face pain n=20
Age	38,81.53 (SD13.34)	46.7 (SD12.98)
CAS	0.45 (SD1.10)	5.87 (SD2.46)

identification of emotions. In addition, the understanding of the physiological component of emotions may be affected negatively. Participants with facial pain (mean value 2.72 ±SD. 0.90, U= 19.28, Z= -19,605, p=.001) achieved significantly higher values than the control group in this scale.

Difficulties in describing emotions (scale 2)

A value of > 3.0 describes a strong impediment of the function to describe one's own feelings and to refer to the physical expression of emotions in this context. This includes deficits in non-verbal communication which affect the recognition of facial expressions. While the healthy control group achieved a low mean value of 2.39 (±SD. 0.44), the values in facial pain patients were significantly higher (mean value 3.03 ±SD. 0.79, U= 22, Z=-18.12, p<0.001).

Externally-oriented style of thinking (scale 3)

An increased value of >3,0 in this dimension can explain problems in analytical thinking. As Figure 1 illustrates, there is not a significant difference between both groups in this scale (mean value facial pain group 3.21±SD. 0.51 U= 49, Z= 4.94).
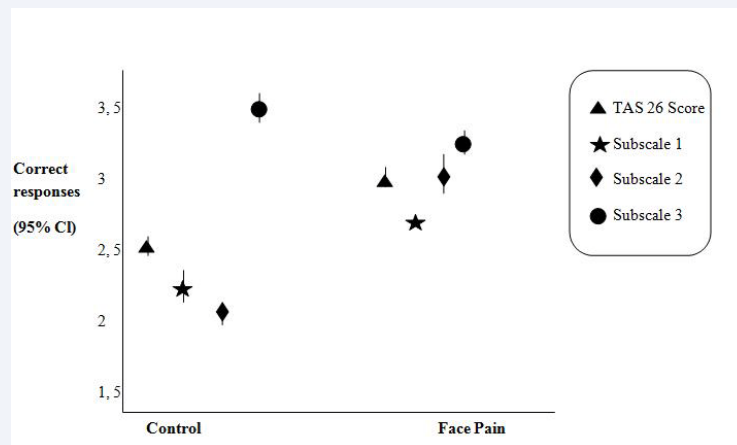
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Figure 2 Mean (filled in shape) and 95% confidence intervals (lines) showing the values of the TAS subscale for the control group and the chronic face pain group. Controls showed higher scores at subscales 1 and 2 (p<.001).

Pain Quality Coloured Analogue Scale CAS

The group of facial pain patients achieved a mean value of 5.87 on the CAS (±SD 2.46,U=48658, Z=-35, p=.001). The healthy control group describes a mean CAS value of 0.45 (±SD 1.10).

If one compares the results of the TAS with the pain values of the CAS using the Spearman correlation coefficient then it shows a positive correlation between the two tests (r=.55, p= 0,02). Therefore, subjects from the facial pain group who had higher pain levels achieved on average higher TAS values than subjects with a lack of pain or lower pain values.

Perception and recognition of facially expressed emotions

Accuracy: Comparison of the results of the FEEL test of both groups demonstrated a significant difference in the ability to recognize emotional facial expressions. There was a main effect of group (U=19, Z=-19.64, p=.001), where the control group (mean value 34, 78±SD. 4.19) was more accurate than the chronic face pain group (mean value 29.47 ±SD, 4.95). Controls were no more accurate at all basic emotion and values of all emotions are distributed similarly in both groups. (p =0.18) (Figure 3).

Moreover, significant differences were noticed when comparing the mean values of all individual basic emotions. Controls were able to recognize more correct facial expressions related to the pictures, but they were shown conspicuous difficulties in recognition of fear, sadness, and disgust (Figure 2).This group was able to recognize happiness, anger and surprise very well.

Response Time

In addition, the time needed to recognize the respective emotions were compared among both groups. The facial pain group needed significantly more time to assign the correct basic emotions to the images (mean value 2.96 seconds for each image ±SD.1, 28, U=24, Z=-15, 62, p=.001) than the control subjects (mean value 1.96 seconds for each image ±SD.0. 64).

If one compares the overall results of the FEEL test and the

TAS, there is a moderate (negative) correlation recognizable (Spearman correlation coefficient r= 0.41, p <0,02).

In addition, when the results of individual mean values of emotions were compared with the overall result of the TAS, a moderate correlation can be observed in the emotions of happiness (r= -.43, p<.05) and disgust (r=.32, p<.05). Participants who were able to recognize facial expressions correctly and are including the emotions happiness and disgust, also showed increased TAS values.

DISCUSSION

Our hypothesis was that people with chronic facial pain would perform worse than controls in identifying facially expressed emotions (FEEL-Test) and that this deficit would not only be explained by the presence of alexithymia. The results do support this hypothesis because participants with chronic facial pain were less accurate at the recognition of facial expressed emotions and were shown higher TAS sum scores than controls. Because of the moderate negative correlation between the FEEL Test and the TAS (r= 0.41, p <0,02),it is suggested that there is an association between cortical emotion processing centres and cortical motor processing in patients with chronic facial pain.

Patients with chronic facial pain show dysfunctional facial emotional recognition. It seems that it is less the presence of the pain disorder itself, rather than higher alexithymia scores, that are related to the FER deficits.. Our results show that alexithymia is an independent factor in the emergence of a somatic pain disorder. This could be reinforced by a former study of Haas et al. [7]. He confirmed in a study investigating FER in combination with Alexithymia and temporomandibular disorders (TMD) that a screening for alexithymia may be a more suitable approach in predicting FER than the information about the presence of a (oro-facial) pain disorder.

Alexithymia is a particularly important clinical variable in psychiatric and psychosomatic disorders.(40) There are proven correlations of chronic pain (in particular facial pain), somatoform disorders and symptoms of depression [10,29,30]. The high values of the current study on the Toronto Alexithymia
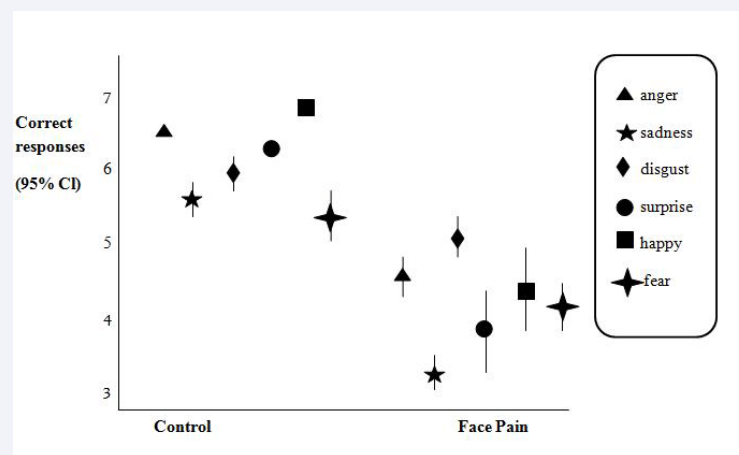
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Figure 3 Mean (filled in shape) and 95% confidence intervals (lines) showing the number of correct responses (out of 7) during the FEEL task for the control group and the chronic face pain group. Controls were more accurate in recognizing the right emotions (p=.001).

Scale (TAS) in pain patients also point in this direction. Based on the current results, it was possible to show an additional correlation of alexithymia characteristics and a deficit in FER. The values in reference to the *identification of emotions* (scale 1) and the *description of emotions* (scale 2) of the TAS were significantly higher in the group of patients with chronic facial pain. This was mainly caused by the outcomes of scale 1 and 2. Because these subscales also refer to the process of perceiving mimic emotions, this observation provides an important correlation with regard to the facial recognition deficit.

The results are similar when compared with the results of other studies on this topic. Glaros and Lumley [31] examined the correlation between painful temporomandibular dysfunction (TMD) and alexithymia in facial pain patients with TMD and compared it with a healthy control group. They demonstrated that the patients with painful TMD had greater problems to identify emotions (scale 1) and had less externally-oriented thinking (scale 3).

The current study shows that patients with chronic facial pain have a difficulty allocating negative emotions to the correct images. Therefore, this burden could explain this observation. It could be possible that pain patients are particularly focused on negative emotions because the basic emotional mood has a great effect on the perception of the affected person [32]. If one feels sad and not understood and ostracized by one's social environment, it can impact the perception of the environment [33-41]. Neutral facial expressions are seen as negative because the human being judges others based on his or her own condition. This may have an additional effect on the social problem of chronic pain. It creates a vicious cycle of negative factors that strengthen one another. In other studies depression may be a comorbidity in persons with Alexithymia which may be also interesting in a facial pain group [42, 43]. At this was not the primary aim in our study, we did not investigate it.

The influence of (face) pain on brain processing and vice versa

It is worth to note that the recognition deficit of facial emotion stimuli is specific for facial pain and not generally observed in other facial disorders like cleft lips in which normal emotion recognition abilities have been found [44-46]. Therefore it is reasonable to discuss whether the emotion recognition deficits are of etiological nature or a result of the pain problem itself. From a clinical point of view both possibilities are important. Unfortunately, there are no long-term studies, in which the emotion recognition are studied before the development of facial pain. However there are some studies on Tension type headache: Traue et al. (2005) found a causal relationship in a time series study over 84 days between inhibited emotional expressiveness on daily pain supporting and a study by Yücel et al. (2002) it was proved that pain intensity covariates with alexithymic processing of emotions [47-49]. This is also confirmed in the study by Von Piekartz et al (2014) in long term atypical facial pain were disrupted motor processing may be strongly associated with reduced emotion recognition [46]. Dysfunctional emotion processes may be part of inefficient coping with social stressors with the result of more stress in social an counter in the long run. This is in accordance with the observation of Nyklicek et al. (2000) when pain tolerance decrease with alexithymia [45]. The well known mechanism of facial feedback may be of relevance. The facial feedback hypothesis claims that the observation of facial stimuli induces small muscular pattern in the observer, which inform the brain about the emotional nature of the social encounter, positive or negative. Havas and colleagues (2010) showed in experimental botox paralysis of facial muscles have a diffusing effect on processing of emotional content [44-49].

In summary it can be concluded that cortical motor processing of facial tasks may be disrupted in people with facial pain. A growing body of the literature showing body-part-specific disruptions of motor processing in chronic pain and raise the possibility that this disrupted motor processing supports, or at least contributes to, the difficulty that people with facial pain have in recognising others' emotions from their facial expressions [33, 34]. It has to be stated that this research design on alexithymia and emotion recognition in a chronic facial pain patients is not specific in this groups and can be extended to other groups of patients. The authors suggest that this research design may be

partly used for other patients suffering from chronic pain and or psychiatric diseases.

CONCLUSION

The study results lead to the conclusion that, in patients with chronic facial pain, not only the recognition of facially expressed emotions is restricted, but also the ability to identify and describe one's own feelings. This relation is particularly important in the treatment of chronic facial pain and it should become part of the treatment plan in addition to the other therapeutic key issues. The quality of life of the affected patients may be influenced positively through a conservative treatment concept, which includes measures to improve the perception of expressive emotions in addition to adequate behavioural therapy [32] and physiotherapy approaches [33-36]. Perception-oriented exercises which train e.g. the recognition of emotional facial expressions through images on a computer program or with visual cards should constitute another key issue in every therapy of chronic facial pain. Another study which will examine the quality criteria by using a computer program to improve perception of facial expression is currently being prepared.

Improving the recognition of patients with chronic facial pain could prevent social conflicts, which can be created by misguided communication. An additional psychological burden of the affected patients could be prevented and as a result they could have an improved quality of life.

This study is approved by the ethics commission of the University of Applied Science Osnabruck, Germany in 2017.

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