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Greater disability with increased pain involvement, pain intensity and depressive preoccupation

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Persistent pain is often accompanied by functional disability. This study investigated the effect of pain extent and the involvement of specific pain sites on pain-related disability, as determined by the Pain Disability Index (PDI). Complete data were available from 278 persistent facial pain (PFP) patients. Patients were divided into one of two groups based on drawings of their pain distribution. When the patient's pain drawing was limited to the region supplied by the trigeminal nerves (Nn. V_1, V_2, and/or V_3), with or without the inclusion of any combination of the cervical dermatomes C2, C3 and C4, the patient was assigned to the local/regional pain group. If the pain extended beyond this area, the patient was allocated to the group exhibiting widespread pain. In addition to the PDI, patients filled out the Beck Depression Inventory (BDI) and the State-Trait Anxiety Inventory (STAI). The local/regional pain group had significantly lower scores on the PDI, the BDI and STAI state than cases with widespread pain. Patients with widespread pain who indicated pain locations in any one or more of the extremities plus the lower back scored significantly higher on the PDI and the BDI than patients with no such combined involvement. Multiple regression analysis revealed that depressive preoccupation, pain extent and pain intensity were significant predictors of pain-related disability, whereas the STAI was not. If controlled for pain extent and pain intensity, the presence of high as opposed to low depressive scores added almost 11 points to the PDI score. These results showed that pain distribution, pain intensity and depressive mood are significant predictors of pain-related disability.

INTRODUCTION

It is widely recognised that persistent pain is often accompanied by functional limitations and restrictions in daily activities (Hawley & Wolfe, 1991; Von Korff *et al.*, 1992; Hazard *et al.*, 1994; Tesio *et al.*, 1997). The term 'disability' is used in the medical and legal arena to refer to these limitations, but a precise definition has not been agreed upon (cf. WHO, 1980; Strang, 1985; Osterweis *et al.*, 1987; Vasudevan,1992; Kopec & Esdaile, 1995; Last, 1995). Persistent pain and pain-related disability result in negative consequences for the individual, family and society. Indeed, suffering and frustration, decreased self-esteem, increased use of medications and health-care services, high disability-related expenditures, loss of productivity and impaired quality of life are frequently found in these patients (Strang, 1985; Osterweis *et al.*, 1987; Dworkin, 1991; Rubenstein, 1996; Turk, 1996).

The Pain Disability Index (PDI) (Pollard, 1981, 1984; Tait *et al.*, 1987) has often been used to measure pain-related disability. Several studies have shown that the PDI is a useful and reliable instrument, and its discriminant, concurrent and construct validities have been documented (Tait *et al.*, 1987, 1990; Grönblad *et al.*, 1990, 1993, 1994; Jerome & Gross, 1991; Dillmann *et al.*,

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1994; Strong *et al.*, 1994). Bush *et al.* (1995), who administered the PDI to 272 patients (among them 220 females) with persistent pain located in the temporomandibular region, reported a mean PDI score of 20.7 (maximum possible score: 70). In contrast, in a sample of 100 patients (50 females) with non-malignant persistent low back pain, the mean PDI score ranged from 40.4 (older patients) to 47.8 (younger patients) (Strong *et al.*, 1994). The present authors hypothesised that the striking difference in reported disability between facial pain and back pain patients must be due to the selective contribution of specific pain locations to the functional limitations of daily life.

With pain not necessarily limited to the face in facial pain patients, the question arises if coexisting pain in other sites than the face contributes to disability to any significant degree, and if these contributions are independent of factors such as pain intensity, depression and anxiety. Specifically, it was hypothesised that patients with pain limited to the trigeminal dermatomes and the adjacent spinal dermatomes C2, C3 and C4 show less disability than presentations with widespread pain involvement. If this is the case, such a finding is likely to have important consequences in the sense that the presence of widespread pain must receive consideration in any therapeutic reasoning.

MATERIALS AND METHODS

The present study sample included 313 consecutive female patients who were referred to a university-based multidisciplinary tertiary care facial pain clinic for evaluation and management of persistent, non-malignant facial pain. The overwhelming majority of the patients (>95%) had musculoskeletal problems commonly embraced under the term 'temporomandibular disorders' (TMDs). Male patients, who make up less than 5% of the present patient population, were not included because their number was too low to examine possible sex effects. Thirty-five individuals did not complete the PDI, reducing the number of complete data sets from 313 to 278 cases. Thirty-four of these 35 patients did not answer the question about the degree to which sexual behaviour was affected by pain, 12 of whom included a hand-written explanation, such as 'widowed' or 'morals'. Others referred to being 'unable to answer this—I have abstained due to bad marital relationship', or 'not sexually active at present'. However, with respect to the other PDI items, responders and non-responders on this particular question did not differ. The median age of the 278 subjects was 37 years (min. 14, max. 73 years), with a median duration of 48 months since the onset of the facial pain condition (range 1–588 months).

Patients were classified into two groups on the basis of pain drawings. Each individual was asked to indicate the painful sites on figures of approximately 15 cm height of the frontal and rear views of a human body (Fig. 1). Patients received written instructions together with examples of how to mark their pain, i.e. to shade in all areas that are painful. The drawings were assessed using transparent templates that showed the segmental arrangement of dermatomes in the frontal and rear views. When the patient's drawing was limited to the region supplied by the trigeminal nerves (Nn. V_1, V_2, and/or V_3), with or without the inclusion of any combination of the cervical dermatomes C2, C3 and C4, the patient was assigned to the local/regional pain group. If the pain extended beyond this area, the patient was allocated to the group exhibiting widespread pain. Based on their pain drawings, 94 individuals (33.8%) were assigned to the group with local/regional pain, and 184 (66.2%) to the group with widespread pain.

In addition to classifying the degree of pain involvement, the authors obtained and analysed self-reports of present pain intensity, and aspects of mood, such as the current anxiety level ('state'), the degree to which an individual was prone to experience anxiety ('trait'), and the level of coexisting depression. The assessment tools included an 11-point numerical rating scale where '0' was 'no pain' and '10' 'pain as bad as could be', the Pain Disability Index (PDI) (Pollard, 1981; Tait *et al.*, 1987), the State-Trait Anxiety Inventory (STAI, form Y) (Spielberger *et al.*, 1977) and the Beck Depression Inventory (BDI) (Beck *et al.*, 1961). The local/regional and widespread pain groups were compared using *t*-tests.

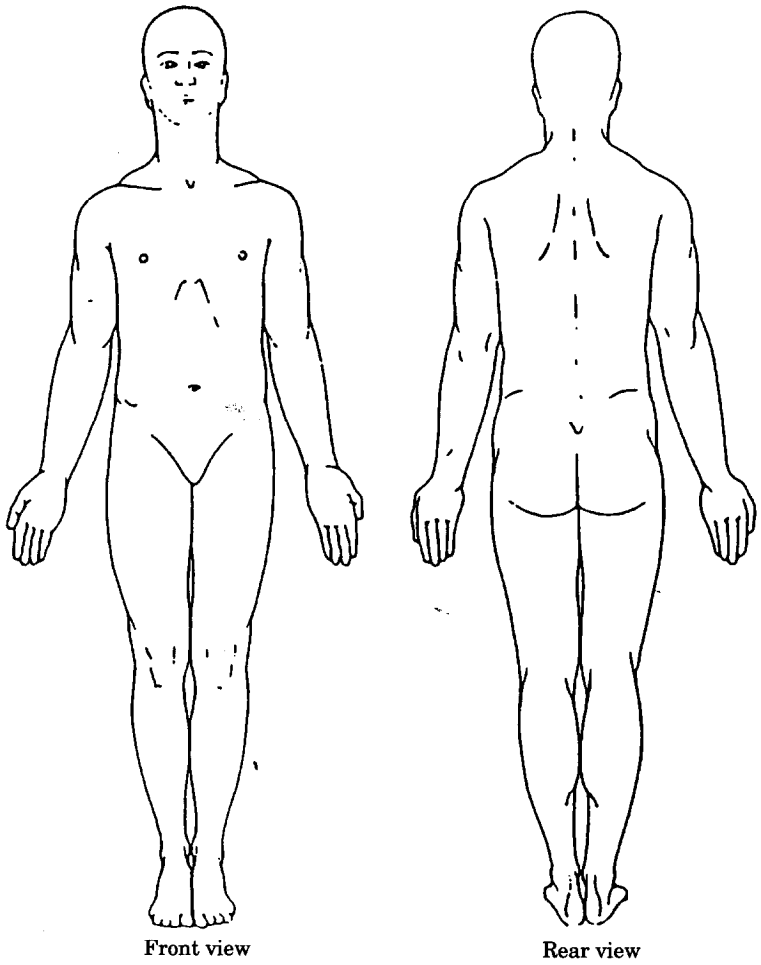

FIG. 1. Sketches of the frontal and rear view of the human body.

With respect to the PDI, patients were asked to indicate on seven numerical scales, each ranging from '0' ('no disability') to '10' ('total disability'), the degree of interference pain causes in the following aspects of daily life: family/home responsibilities, recreation, social activity, occupation, sexual behavior, self care, and life support activity (Pollard, 1984; Tait *et al.*, 1987). Mean PDI scores were calculated for the groups with local/regional and widespread pain.

Pain drawings of cases assigned to the group with widespread pain were subsequently re-assessed with templates in which the areas covering the arms and legs (frontal and rear views), as well as the low back region (rear view), were marked. The authors further assigned patients with widespread involvement into one of four subgroups: (1) no involvement of any of the four extremities and the lower back (EX−LB−); (2) involvement of lower back in the absence of any involvement of the extremities (EX−LB+); (3) involvement of at least one or more of the extremities in the absence of painful lower back involvement (EX+LB−); and (4) painful involvement of at least one or more extremities in combination with pain in the lower back (EX+LB+). Mean values were compared by one-way analyses of variance. In cases of significant associations, Scheffe's test was applied to see which specific pairs of groups were significantly different from each other. To find out if pain distribution, BDI, pain intensity, STAI state, or STAI trait were significant predictors of pain-related disability, a multiple regression analysis was performed.

Further data exploration was based on the assignment of patients based on their BDI scores. Using the recommendation of Turner and

TABLE 1. Mean patient scores for Pain Disability Index (PDI), Beck Depression Inventory (BDI), State-Trait Anxiety Inventory (STAI, T scores), and pain intensity measures depending on pain distribution

Measures	Pain distribution		Significance p
	Local/regional Mean (SD)	Widespread Mean (SD)	
PDI	18.70 (15.28)	29.09 (17.36)	<0.001, s.
BDI	10.10 (7.77)	13.31 (9.32)	0.009, s.
STAI state	47.47 (10.23)	50.74 (9.81)	0.02, s.
STAI trait	50.79 (7.57)	52.28 (8.39)	0.20, n.s.
Pain intensity	6.48 (2.34)	6.50 (2.08)	0.94, n.s.

Local/regional pain distributions refer to pain in the trigeminal dermatomes V_1, V_2 and V_3 with possible extension of pain to the cervical dermatomes C2, C3 or C4, whereas widespread involvement refers to additional pain in areas beyond the C4 dermatome. s., significant; n.s., not significant; SD, standard deviation.

Romano (1984), the cut-off score of 13 was adopted to distinguish pain patients with low BDI scores (<13) from those with high depressive scores (≥ 13). Taking this categorical distinction into account, a multiple regression analysis was again performed to determine whether the grouping of cases according to the level of depressive mood diminished the predictive power.

RESULTS

The overall PDI score was 22 (range 0–70). Table 1 summarises the descriptive statistics and the results of the *t*-tests for the groups with local/regional and widespread pain. Patients with widespread pain differed significantly from patients with local/regional pain on three variables, namely the PDI, the BDI and the state portion of the STAI. No significant differences were found for the trait scale of the STAI or pain intensity with respect to the extent of pain involvement.

The mean scores for the four subgroups of patients are given in Table 2. Patients with pain in at least one of the four extremities and involvement of the lower back scored significantly higher on both the PDI and BDI than patients without the combined involvement of extremities and low back. In contrast to the disability measure, no differences were found for the present pain intensity and the STAI.

The multiple regression analysis revealed that BDI, pain extent and pain intensity were significant predictors for pain-related disability, whereas the STAI was not. Subsequently, the authors performed a second regression analysis, keeping the PDI score as the dependent variable, eliminating the data derived from the STAI. It was found that when controlling for intensity and depression, a widespread pain distribution was associated with a PDI score that is about 11 points higher than that for a local/regional pain presentation (Table 3).

Using the recommended BDI cut-off point of 13, 57.6% of the patients exhibited mean scores that were below this threshold, whereas the remaining 42.4% had a score of 13 or greater. In Table 4, the multiple regression was repeated using this categorical low/high distinction in place of the actual BDI score. Comparison of the coefficients of determination (R^2) of the two regression models (34 *vs* 33%) showed that the categorical high/low distinction and the actual BDI score were similarly useful in predicting pain-related disability.

Subsequently, the authors examined the

TABLE 2. Mean patient scores for the Pain Disability Index (PDI), Beck Depression Inventory (BDI), State-Trait Anxiety Inventory (STAI) and present pain intensity in the four subgroups with widespread pain

Measures	Involvement of specific sites in cases showing widespread pain distributions				p	Comment
	No low back and no extremities (EX-LB−)	Low back and no extremities (EX-LB+)	No low back, but extremities (EX+LB−)	Low back and extremities (EX+LB+)		
PDI	26.59 (16.18)	23.56 (15.41)	28.81 (19.31)	34.02 (16.71)	0.038 s.	(EX−LB+) ≠ (EX+LB+)
BDI	10.78 (7.55)	12.09 (7.64)	12.64 (9.34)	16.80 (10.66)	0.012 s.	(EX−LB−) ≠ (EX+LB+)
STAI state	49.52 (8.47)	49.19 (7.36)	50.03 (10.70)	53.28 (11.08)	0.209 n.s.	
STAI trait	50.77 (6.82)	51.55 (7.49)	52.14 (9.03)	54.28 (9.52)	0.228 n.s.	
Pain intensity	5.91 (1.74)	6.24 (1.68)	7.08 (2.23)	t6.61 (2.23)	0.111 n.s.	

Standard deviations are given in parentheses. ≠, significantly different from. s., significant; n.s., not significant.

TABLE 3. Multiple regression models with the Pain Disability Index (PDI) as dependent variable

Variable	Multiple Regression Model			
	Five variables		Following elimination of STAI	
	RC	p	RC	p
BDI score	0.68	0.001, s.	0.69	<0.0001, s.
Pain distribution	10.92	0.001, s.	11.06	<0.0001, s.
Pain intensity	1.77	<0.003, s.	2.32	<0.0001, s.
STAI state	0.33	0.11, n.s.		
STAI trait	−0.27	0.77, n.s.		

Variables are ranked according to predictive power. RC, regression coefficient; s., significant; n.s., not significant; BDI, Beck Depression Inventory; STAI, State-Trait Anxiety Inventory.

TABLE 4. Multiple regression model with the Pain Disability Index (PDI) as dependent variable

Variable	Multiple regression model	
	RC	p
BDI: low *vs* high	10.66	<0.0001, s.
Pain distribution: local/ regional *vs* widespread	10.99	<0.0001, s.
Pain intensity: 0–10	2.32	<0.0001, s.

RC, regression coefficient; s., significant. The Beck Depression Inventory (BDI) group variable is used as a predictor variable.

occurrence of high/low depressive scores with respect to whether differences existed between cases with local/regional or widespread pain. Four clusters of cases were distinguished, i.e. (1) low depressive preoccupation with local/regional pain distribution (Depr−LR); (2) low depressive pre-occupation with widespread pain distribution (Depr−W); (3) high depressive preoccupation with local/regional pain distribution (Depr+LR); and (4) high depressive pre-occupation with widespread pain distribution (Depr+W). Using the PDI as dependent variable, an analysis of variance was performed to examine whether statistically significant differences could be identified.

Results are presented in the form of a scatter plot with four regression lines (Fig. 2). The four regression lines correspond to the case clusters

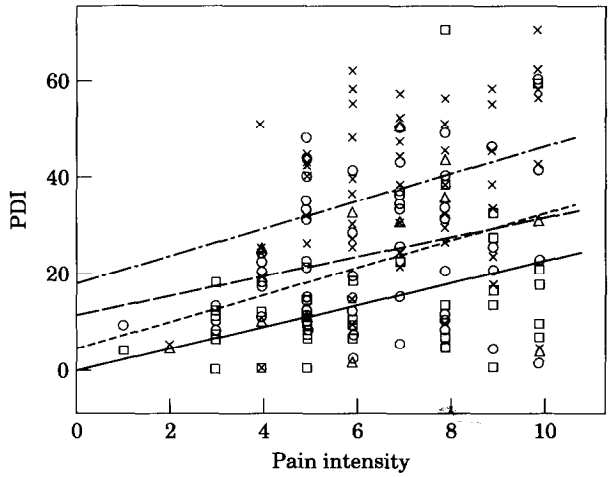

FIG. 2. Scatter plot with regression lines corresponding to the case clusters that were defined by any of the four combinations of either high (Depr+) or low depression scores (Depr−) and either local/regional (LR) or widespread (W) pain distributions (Depr−LR (□), Depr−W (○), Depr+LR (△), and Depr+W(×)). Notable is the fact that for any given level of pain intensity, increasing levels of disability were found in cases that exhibited Depr-LR, Depr−W and Depr−LR, to Depr+W. PDI, Pain Disability Index.

that were defined by the four combinations of either high or low depression scores and either local/regional or widespread pain distributions (Depr−LR, Depr−W, Depr+LR and Depr+W). Notable is the fact that for any given level of pain intensity, increasing levels of disability were found in cases that exhibited Depr−LR, Depr−W and Depr−LR, to Depr+W. Cases with widespread pain and high depressive scores showed the highest level of disability. The differences among the groups (Depr−LR, Depr−W, Depr+LR and Depr+W) proved to be statistically significant ($p<0.0001$). In cases with low depressive scores, PDI scores increased from 14.1 (SD: 13.3) to 22.4 (SD: 14.7), and among patients with high depressive scores, the PDI scores increased from 27.64 (SD: 17.8) to 37.78 (SD: 16.5) with greater pain involvement.

DISCUSSION

The results of this investigation demonstrated that functional limitations of daily life were a widespread phenomenon among persistent facial pain patients. Pain-related disability was associated with pain distribution as well as depressive preoccupation. In the case of widespread pain, disability was also influenced by specific pain locations.

The authors' initial hypothesis that PFP patients with low back pain experience greater disability than PFP patients with no such pain proved to be true only for those individuals who experienced pain in at least one of the four extremities as well. On the other hand, involvement of any of the extremities in the absence of low back pain did not cause any statistically significant increase in PDI scores.

The conspicuous differences in PDI scores reported by Bush *et al.* (1995), who evaluated patients with temporomandibular pain (mean PDI: 20.7), and Strong *et al.* (1994), who assessed low back pain patients (mean PDI: >40), can therefore not simply be explained by the topographical pain involvement. It is important to note, however, that the PDI scores in the present study were closer to those reported by Bush *et al.* (1995) than those obtained by Strong *et al.* (1994).

Using the recommended cut-off point of 13 for the BDI (Turner and Romano, 1984), about 40% of the study patients were characterised as being considerably affected by some form of depressive preoccupation. This is also supported by the findings of other authors, who used both the BDI and PDI as assessment tools. Across various chronic pain conditions, such as chronic low back pain (Strong *et al.*, 1994), headaches (Tschannen *et al.*, 1992), and post-traumatic headaches (Duckro *et al.*, 1995), significant associations exist between depression and self-reported pain-related disability.

The STAI, the first version of which was introduced in 1966 (Spielberger & Gorsuch, 1966), is a widely used self-report measure of anxiety (Levitt, 1980). In 1977, the Y-version of the STAI became available (Spielberger *et al.*, 1977), which replaced the earlier X-form of the instrument (Spielberger *et al.*, 1970). The Y-form differs considerably from the X-version in that the choice of wording was altered in 12 out of 40 items. Even in most of the recent publications, reference is made to the original manual of the X-form from 1966, raising doubts about the actual form

of the test employed in work published after the introduction of the Y-form in 1977. For this reason, the authors purposely avoided any comparison of these results with reports of others.

In summary, this study has demonstrated that additional pain occurring outside the face contributed substantially to the functional limitations reported by persistent facial pain patients. It was also found that the level of depressive preoccupation and present pain intensity were significant factors in the multiple regression model.

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