Catastrophizing, anxiety and pain during dental hygiene treatment


Abstract – Objectives: This study examined the relations between catastrophizing, dental anxiety, and pain during dental hygiene treatment. Methods: Participants were 78 (32 men, 46 women) consecutive referrals to the Dalhousie University Dental Clinic. All patients were scheduled for a scaling procedure performed by senior dental hygiene students. Following treatment, patients completed the Pain Catastrophizing Scale and the Dental Anxiety Scale – Revised, and were asked to rate the degree of pain they experienced during the scaling procedure. Results: Regression analyses revealed that age and the rumination subscale of the Pain Catastrophizing Scale were significant predictors of pain, even when controlling for gender, and oral hygiene status. Conclusions: The findings suggest that excessive focus on pain sensations may be one of the mechanisms by which catastrophizing leads to increased pain. The clinical challenges will be to develop cost- and time-effective means of identifying individuals who catastrophize and to implement interventions to reduce their level of distress.

Increased attention to oral hygiene practice and the development of highly effective local anaesthetics have led to significant reductions in the pain and discomfort associated with dental treatment. However, a substantive proportion of individuals continue to report high levels of physical and emotional distress during dental procedures (1–4). Several investigators have suggested that psychological factors may be important contributors to the experience of distress during dental treatment (3, 5, 6).

To date, numerous investigations have shown that individuals who ‘catastrophize’ during painful stimulation experience more pain and emotional distress than individuals who do not catastrophize (3, 7, 8). In pain research, catastrophizing has been broadly defined as an exaggerated negative orientation toward painful stimuli (3, 7). In recent work, pain catastrophizing has been conceptualized as a multidimensional construct comprising rumination (e.g., “I keep thinking about how much it hurts”), magnification (e.g., “I wonder whether something serious may happen”), and helplessness (e.g., “It’s awful and I feel that it overwhelms me”) (7). A relation between catastrophizing and heightened pain experience has been observed in several populations including chronic pain patients (9), patients undergoing aversive medical procedures (7), and participants in experimental pain studies (7, 8).

The purpose of the present research was to examine the relation between catastrophizing and pain during dental treatment. Although a consistent relation has been observed between catastrophizing and pain under a variety of aversive conditions, it remains unclear whether catastrophizing contributes to pain experience during dental hygiene procedures. It is also unclear whether each of the three components of catastrophizing contributes significantly to the prediction of pain during dental treatment, or whether certain components of catastrophizing are more predictive than others. Information concerning the components of catastrophizing most predictive of pain during dental treatment may help tailor interventions in a manner that may decrease distress responses.

It is also necessary to address whether cat-
astrophizing is distinct from more basic emotional variables that have been shown to be associated with physical and emotional distress during dental treatment. For example, numerous investigations have shown that dental anxiety is a significant predictor of physical and emotional distress during dental treatment (4, 6). Research has also shown an association between catastrophic thinking and dental anxiety (5). Research has yet to address whether astrophizing contributes to the prediction of pain over and above the variance accounted for by dental anxiety. If the relation between astrophizing and pain can be accounted for by dental anxiety, then the construct would not add to our understanding of the determinants of dental pain.

In the present study, patients scheduled for dental hygiene treatment were asked to complete measures of astrophizing, dental anxiety, and pain. The questions addressed by the present research can be summarized as follows:

1) Is astrophizing a significant predictor of pain during dental hygiene treatment?
2) What are the components of astrophizing that are most predictive of pain during dental hygiene treatment?
3) In the prediction of pain, can astrophizing be distinguished from dental anxiety?

**Material and methods**

Participants were 78 (32 men, 46 women) consecutive referrals to the Dalhousie Dental Clinic. All participants were scheduled for scaling procedures performed by senior dental hygiene students (n = 39).

**Measures**

**Oral hygiene index** – A 4-point severity scale was used to indicate the location and distribution of hard and soft deposits on the teeth, ranging from 1 (minimal supragingival plaque and calculus) to 4 (heavy supragingival and/or sub-gingival plaque, calculus, and staining). The amount of deposits present on the teeth can be construed as an index of oral hygiene practice, where increasing levels of plaque and calculus reflect poor oral hygiene. Categorization of location and distribution of deposits was done by dental hygiene students and confirmed by dental hygiene faculty.

**Astrophizing** – The Pain Catastrophizing Scale (PCS) (7) is a 13-item measure on which respondents rate the frequency with which they typically experience different thoughts and feelings when in pain. Ratings are made on a 5-point scale with the endpoints 0 (never) and 4 (always). The PCS yields a total score and three subscale scores assessing rumination, magnification and helplessness. The PCS has been shown to have high internal consistency (coefficient alphas: total PCS=0.87, rumination=0.87, magnification=0.66, and helplessness=0.78). The PCS has been shown to be stable for a 6–8 week period (test-retest r=0.78) (7).

**Dental anxiety** – The Dental Anxiety Scale – Revised (DAS-R, check-up version) (10) assesses the degree to which participants experience fear or anxiety when imagining different aspects of dental procedures (i.e., preparing for a check-up, waiting for their turn in the chair, waiting while the dentist prepares the drill, and waiting while the dentist or hygienist prepares the scaling instruments). Participants’ responses are summed to yield a total score where higher values reflect more intense dental anxiety. The DAS-R has been shown to be internally reliable (coefficient alpha=0.82) (10).

The DAS-R (10) differs from the original DAS (4) only insofar as the wording has been altered slightly to include reference to procedures involved in dental hygiene treatment. The normative values reported for the DAS-R (10) are similar to those reported for the DAS (4, 11).

**Pain** – Participants were asked to rate the degree of pain they experienced during the scaling procedure on an 11-point scale with the endpoints 0 (no pain) and 10 (extreme pain).

All patients were scheduled for scaling procedures. None of the patients received local anesthetic. Immediately following treatment, dental hygiene students provided patients with a questionnaire package containing the PCS, the DAS-R, and the pain scale. The patients were assured that responses would remain anonymous and that participation in the study was voluntary. Patients completed and returned these measures before leaving the dental clinic.

**Results**

**Sample characteristics**

Means, standard deviations, and ranges on all dependent variables are presented in Table 1. The mean age of the sample was 42.2 years, and women were significantly older (mean=45.5, s=15.8) than men (mean=37.4, s=13.3), t (79)=2.4, P<0.02.

The mean of pain ratings for the sample was 1.8 (s=1.9) indicating that most subjects experienced minimal pain. A mean of 1.8 (s=0.7) on the oral
Table 1. Sample characteristics

<table>
<thead>
<tr>
<th></th>
<th>Mean</th>
<th>Standard deviation</th>
<th>Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td>42.2</td>
<td>15.3</td>
<td>16–79</td>
</tr>
<tr>
<td>Pain</td>
<td>1.8</td>
<td>1.9</td>
<td>0–7</td>
</tr>
<tr>
<td>PCS</td>
<td>10.9</td>
<td>9.5</td>
<td>0–45</td>
</tr>
<tr>
<td>DAS-R</td>
<td>7.1</td>
<td>3.5</td>
<td>4–18</td>
</tr>
<tr>
<td>Oral hygiene index</td>
<td>1.8</td>
<td>0.7</td>
<td>1–3</td>
</tr>
</tbody>
</table>

Note: pain = self-reported pain intensity, PCS = Pain Catastrophizing Scale, DAS-R = Dental Anxiety Scale – Revised.

Table 2. Correlations among measures

<table>
<thead>
<tr>
<th></th>
<th>PCS</th>
<th>DAS-R</th>
<th>Pain</th>
<th>Age</th>
<th>DAS-R</th>
<th>Pain</th>
<th>Age</th>
</tr>
</thead>
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<tr>
<td>DAS-R</td>
<td>0.47*</td>
<td></td>
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<tr>
<td>Pain</td>
<td>0.51*</td>
<td>0.30*</td>
<td></td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>Age</td>
<td>−0.35*</td>
<td>−0.26*</td>
<td>−0.55*</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Oral hygiene index</td>
<td>0.01</td>
<td>0.30*</td>
<td>0.00</td>
<td>0.03</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note: pain = self-reported pain intensity, PCS = Pain Catastrophizing Scale, DAS-R = Dental Anxiety Scale – Revised. * = P<0.01.

The gender distribution and age range are similar to those reported by de Jong & Stouthard (12) in a sample of 101 patients referred to a community health centre for dental hygiene treatment. The mean DAS-R score of 7.1 (±3.5) is slightly lower than the value of 8.4 (±3.3) reported by Ronis (10) in a normative sample of 662 community adults.

Correlations among measures

As shown in Table 2, pain was positively correlated with catastrophizing, dental anxiety, and inversely correlated with age. In addition to its relation with pain, catastrophizing was positively correlated with dental anxiety, and inversely correlated with age. Dental anxiety was also positively correlated with the oral hygiene index.

Catastrophizing and pain

A regression analysis was conducted to address the relative contributions of the rumination, magnification, and helplessness subscales of the PCS to the prediction of pain. In the first step of the analysis, age, gender, and oral hygiene status were entered, yielding a multiple $R$ of 0.56, $F (3, 74) = 11.3$, $P<0.001$. The three subscales of the PCS were entered in the second step of the analysis, contributing an additional 12% of the variance to the prediction of pain, $F$ change = 5.1, $P<0.002$. Examination of beta weights in the final regression equation revealed that age, and the rumination subscale of the PCS contributed significant unique variance to the prediction of pain. These results are presented in Table 3.

A second regression analysis was conducted to address the relative contributions of dental anxiety and catastrophizing to the prediction of pain. In the first step of the analysis, age, gender, and oral hygiene status were entered, yielding a multiple $R$ of 0.56, $F (3, 74) = 11.3$, $P<0.001$. Dental anxiety was entered in the second step of the analysis, but failed to add significantly to the prediction of pain, $F$ change = 2.7, $P<0.10$. The PCS was entered in the last step of the analysis contributing an additional 10% of variance to the prediction of pain, over and above the variance contributed by variables entered in steps 1 and 2, $F$ change = 11.4, $P<0.001$. Examination of the beta weights in the final regression equation revealed that only age and the PCS contributed significant unique variance to the prediction of pain. These data are presented in Table 4.

Table 3. Regression analysis examining the contributions of different components of catastrophizing to the prediction of pain

<table>
<thead>
<tr>
<th>Variables</th>
<th>Beta</th>
<th>$R$</th>
<th>$F$ change</th>
<th>$P$</th>
<th>$r$</th>
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<tbody>
<tr>
<td>Step 1</td>
<td>Age</td>
<td>−0.44*</td>
<td>−0.55*</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Gender</td>
<td>0.04</td>
<td>0.15</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Oral hygiene index</td>
<td>0.02</td>
<td>0.56</td>
<td>11.3</td>
<td>0.001</td>
</tr>
<tr>
<td>Step 2</td>
<td>Rumination</td>
<td>0.29*</td>
<td>0.66</td>
<td>5.1</td>
<td>0.002</td>
</tr>
<tr>
<td></td>
<td>Magnification</td>
<td>0.01</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Helplessness</td>
<td>0.12</td>
<td></td>
<td></td>
<td></td>
</tr>
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</table>

Note: While the multiple Rs, $F$ change, and $P$ values refer to statistics at respective steps of the analysis, the beta weights are those computed following the last step of the analysis. 

* = $P<0.05$, † = $P<0.01$.  

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Table 4. Regression analysis comparing the relative contributions of dental anxiety and catastrophizing to the prediction of pain

<table>
<thead>
<tr>
<th>Variables</th>
<th>Beta</th>
<th>R</th>
<th>F change</th>
<th>P</th>
<th>r</th>
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</thead>
<tbody>
<tr>
<td>Step 1</td>
<td>Age</td>
<td>0.44*</td>
<td>0.55*</td>
<td>0.001</td>
<td>0.02</td>
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<tr>
<td></td>
<td>Gender</td>
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<tr>
<td></td>
<td>Oral hygiene index</td>
<td>0.02</td>
<td>0.56</td>
<td>11.3</td>
<td>0.001</td>
</tr>
<tr>
<td>Step 2</td>
<td>DAS-R</td>
<td>0.04</td>
<td>0.58</td>
<td>2.7</td>
<td>0.10</td>
</tr>
<tr>
<td>Step 3</td>
<td>PCS</td>
<td>0.37*</td>
<td>0.66</td>
<td>11.4</td>
<td>0.001</td>
</tr>
</tbody>
</table>

Note: While the multiple Rs, F change, and P values refer to statistics at respective steps of the analysis, the beta weights are those computed following the last step of the analysis. * = P < 0.01.

Discussion

The results of the present study indicate that catastrophizing plays an important role in the experience of pain during dental hygiene treatment. Catastrophizing accounted for significant variance in pain ratings even after the effects of age, gender, and oral hygiene status had been controlled for. The rumination subscale of the PCS showed the strongest relation to pain ratings; patients who endorsed items such as “I keep thinking about how much it hurts”, and “I can’t seem to keep it out of my mind” were particularly likely to experience heightened levels of pain.

The findings suggest that excessive focus on pain sensations may be one of the mechanisms by which catastrophizing leads to increased pain. Several investigators have suggested that attending to pain sensations may serve to amplify the experience of pain (7, 13, 14). Others have suggested that catastrophizers’ tendency to focus on pain sensations may interfere with the effective use of pain coping strategies (8). The findings suggest that interventions that help catastrophizers to turn their attention away from pain could be useful in reducing their level of pain during dental treatment.

However, there are indications that efforts to assist catastrophizers to turn their attention away from pain may meet with unexpected challenges. For example, Heyneman et al. (15) reported that individuals who catastrophized were unable to make effective use of distraction strategies to reduce their pain. Similarly, Sullivan et al. (16) found that catastrophizing was associated with a high frequency of pain-related thought intrusions when participants were asked to suppress thoughts about an upcoming painful procedure. Recently, Sullivan & Neish (17) reported that, for individuals who obtained high scores on a measure of catastrophizing, emotional disclosure was effective in reducing levels of emotional distress and pain experienced during a dental procedure. For individuals who catastrophized, the opportunity to disclose their dental worries and concerns before the dental procedure resulted in lower ratings of pain and emotional distress. Ironically, these findings suggest that, for individuals who catastrophize, interventions that foster expression of pain-related worries and concerns prior to treatment may be more effective in reducing distress reactions than interventions that foster inhibition or control of pain-related cognitions.

Consistent with previous research, dental anxiety was correlated with pain ratings and with oral hygiene status (18, 19). Several investigations have shown that dentally anxious individuals experience more distress during dental procedures, and they are likely to avoid regular dental care (10, 18). Unlike dental anxiety, catastrophizing was not correlated with the oral hygiene index. Thus, while catastrophizing may contribute to heightened pain experience, catastrophizing differs from dental anxiety in that it appears to be unrelated to individuals’ oral hygiene practice.

Catastrophizing has been discussed in previous literature as a cognitive component of anxiety and depression (19, 20). It is possible to speculate that catastrophizing may represent a cognitive component or antecedent of dental anxiety (5). Through excessive focus on painful sensations, the heightened pain experience of catastrophizers may lead them to develop high levels of dental anxiety, which in turn may contribute to avoidance of dental care. This perspective suggests that interventions that target catastrophizing cognitions may be useful in reducing and perhaps even preventing the development of dental anxiety.

While it is tempting to suggest that catastrophizing and dental anxiety may be distinct constructs, it is important to consider the effects of...
sampling biases inherent in studying self-referred clinic attenders. Available research suggests that individuals high in dental anxiety avoid dental visits and therefore tend to be under-represented in self-referred samples. For example, only two patients in the present sample scored 15 or above on the DAS-R, indicating that most patients were not suffering from clinically significant dental anxiety (11). Thus, even though catastrophizing contributed unique variance to the prediction of pain, the under-representation of verbally anxious patients precludes firm conclusions about the distinctiveness of dental anxiety and catastrophizing.

In previous research, both catastrophizing and dental anxiety have been discussed as a stable trait-like variables (3, 10). Proceeding from this view, it is possible to propose that catastrophizing and dental anxiety were causally related to heightened pain ratings during dental treatment. However, it is important to note that measures of catastrophizing and dental anxiety were obtained only following dental treatment, and thus the direction of causality remains unknown. Furthermore, given that both the dental anxiety and the catastrophizing measures contain items that can be interpreted in situational terms, the predictive value of these measures in relation to patients’ pain ratings may have been inflated (11).

The results revealed that age was inversely correlated with pain intensity. Observed relations between age and pain have been discussed from both physiological and psychological perspectives. For example, age-related changes in physiological functioning associated with the loss of synapses and neurons, the atrophy of dendrites, and reductions in levels of central neurotransmitters may interfere with the processing of painful stimuli (22). Pain reports may also be influenced by age-related social norms for the expression of distress or, similarly, by period-related factors where older patients may have learned a more stoic orientation toward the expression of distress (23).

In summary, the findings of the present study suggest that catastrophizing may be an important determinant of pain experience during dental treatment. If future prospective research shows that catastrophizing leads to increased pain and distress during dental treatment, the clinical challenges will be to develop cost- and time-effective means of identifying individuals who catastrophize and to implement interventions to reduce their level of distress. Given that pain is considered to be a significant determinant of avoidance of dental care, strategies for effective pain reduction, particularly in individuals who are prone to experiencing high levels of pain, may have beneficial effects on individuals’ oral health (10, 24).

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References

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