Psychosocial predictors of affect in adult patients undergoing orthodontic treatment

Cecilia Peñacoba*, M José González**, Noelia Santos** and Martín Romero**
Departments of *Psychology and **Orthodontics, Rey Juan Carlos University, Alcorcón, Madrid, Spain

Correspondence to: Martín Romero, Department of Orthodontics, Rey Juan Carlos University, Avda. de Atenas s/n, 28922 Alcorcón, Madrid, Spain. E-mail: martin.romero@urjc.es

SUMMARY In this paper we propose to study the role of psychosocial variables in affect in adult patients undergoing orthodontic treatment, considering that affect is a key variable in treatment adherence. Seventy-four patients (average age 33.24 ± 10.56) with metal multibracket-fixed orthodontic treatment were included. Patients were assessed twice. The first stage, at the beginning of treatment, included assessment of dental impact (Psychosocial Impact of Dental Aesthetics Questionnaire), trait anxiety (State-Trait Anxiety Inventory), self-esteem (Rosenberg’s self-esteem scale), and self-efficacy (General Self-efficacy Scale). In the second stage, 6 months later, positive and negative affect towards treatment was assessed using the Positive and Negative Affect Scale. Dental social impact differentiates between patients with high and low negative affect, while self-efficacy differentiates between patients with high and low positive affect. Trait anxiety and self-esteem differentiate between both types of affect (positive and negative). Trait anxiety and self-esteem (when trait anxiety weight is controlled) are significant predictor variables of affective balance. These results have important practical implications, because it seems essential to adopt a bio-psychosocial model incorporating assessment methods focusing on day-to-day changes in mood and well-being.

Introduction

Numerous studies, from a bio-psychosocial model, show that patient’s negative emotions towards orthodontic treatment affect patient satisfaction with treatment and treatment itself (Francischone et al., 2003; McMullan et al., 2003). In fact, Vojdani and Horgian (1977) described a psychological typology of patients related to anxiety levels based on their adherence to treatment. Within this line of research, most studies have focused on anxiety and pain as key variables in orthodontic treatment adherence, mostly in children and adolescent populations (Norton and Markowitz, 1971; Maj et al., 1967), particularly affected by physical or mental deficiency (Radovich et al., 1991).

Regarding anxiety, studies have found that, in general, surgical-orthodontic patients do not experience psychiatric problems related to their dentofacial disharmony. However, subgroups of patients may still experience problems, such as anxiety or depression (Alanko et al., 2010), or a greater dissatisfaction with their physical appearance (Williams et al., 2009). These same authors (Alanko et al., 2010) highlighted the need to incorporate new assessment methods focusing on day-to-day changes in emotion and well-being, unrelated to psychiatric diagnostic measures.

In practice, different reports have analysed the effect of certain procedures on decreasing anxiety in orthodontic treatment, providing complementary written information (Wright et al., 2010), or using relaxation techniques (Trakyali et al., 2009), structured telephone calls (Bartlett et al., 2005), and psychological training of orthodontists (Schwartz, 1985).

Pain is a determining variable of adherence to orthodontic treatment (90–95 per cent of patients report experiencing pain during treatment—Alanko et al., 2010; Agou et al., 2011), because the idea of having a painful experience discourages many patients from such treatment (Bergius et al., 2008). Anxiety in combination with low motivation for orthodontic treatment, and low activity temperament characterized patients that report pain during orthodontic treatment (Bergius et al., 2008).

Of greater interest to our work are studies examining the role of certain psychosocial variables in orthodontic treatment, mediated by their possible influence on patients emotion. Patient’s emotion towards treatment is determined by a set of psychological variables that can influence not only the final decision of whether or not to undergo orthodontic treatment, but if the patient maintains it, once started (Azuma et al., 2008). Studies in this regard are rather scarce. Agou et al. (2011) showed that children with better psychological well-being are more likely to report better quality of life regardless of their orthodontic treatment status. Sergl et al. (1992) in the evaluation of patient compliance in orthodontics showed that none of the social indicators could predict co-operation, but that psychological scales about orthodontic attitudes, impulsiveness and dominance showed a significant association with co-operation later on. Kenealy et al. (2007) show that dental status alone is a weak
predictor of self-esteem at orthodontic treatment outcome. Self-esteem was more strongly predicted by perception of quality of life, life satisfaction, self-efficacy, depression, social anxiety, emotional health, and by self-perception of attractiveness at outcome.

In conclusion, in the field of orthodontic treatment, different studies show the determining influence of emotion in adherence and satisfaction with treatment, especially positive emotions (Trakyali et al., 2009); there are few studies that analyze the psychosocial variables that influence emotion, especially in adults (Yin et al., 2010). In this paper we propose to study the relative importance of these variables in affect, as a key emotional variable in relationship to treatment adherence, in a sample of adult patients undergoing orthodontic treatment.

Subjects and methods

Design and Sample

A longitudinal prospective design was used. The sample consisted of 74 patients recruited from the Rey Juan Carlos University Clinic (Master of Orthodontics and Dentofacial Orthopedics) in Madrid, Spain, all of whom had moderate malocclusions and were going to receive orthodontic treatment for around 18 months with fixed metal multibrackets.

Our inclusion criteria were the following: being 18 years of age or older; having a proficient level of written and spoken Spanish; and not having been professionally diagnosed with a mental disorder. Our study was approved by the Local Human Research Committee. All participants signed a declaration of informed consent prior to their inclusion in the study.

The average age was of 33.24 ± 10.56 years, 44.7 per cent being male, and most had a steady partner (71.1 per cent). As for participants’ educational level, 13.2 per cent had completed primary education, 28.9 per cent had completed secondary education, and 57.9 per cent had a higher education. Most of the patients (71 per cent) were employed at the time of the study (see Table 1).

The reasons for seeking treatment were one or more of the following (scores indicate average scores on a scale from 1—strongly disagree to 4—quite agree): dentist’s opinion (2.97), desire to correct the facial appearance (2.95), crowded teeth (2.84), the opinion of others (2.12), spaced teeth (2.04), have pain or a ‘click’ in the joint or around the ears (1.79), and difficult to speak and eat (1.71).

Instruments and measures

Anxiety remains a predictor of affect; as stated, it is one of the most studied psychosocial variables in the relationship between emotion and orthodontic treatment. Other predictors that remain are perceived dental impact, self-esteem, and self-efficacy.

<table>
<thead>
<tr>
<th>Table 1</th>
<th>Sociodemographic and psychosocial variables of the sample.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean (SD) or % Theoretical range</td>
<td></td>
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<tr>
<td>Sociodemographic variables</td>
<td></td>
</tr>
<tr>
<td>Age</td>
<td>33.24 (10.56)</td>
</tr>
<tr>
<td>Education level</td>
<td></td>
</tr>
<tr>
<td>Primary</td>
<td>13.2%</td>
</tr>
<tr>
<td>Secondary</td>
<td>28.9%</td>
</tr>
<tr>
<td>University</td>
<td>57.9%</td>
</tr>
<tr>
<td>Gender</td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>44.7%</td>
</tr>
<tr>
<td>Female</td>
<td>55.3%</td>
</tr>
<tr>
<td>Psychosocial variables</td>
<td></td>
</tr>
<tr>
<td>Dental self-confidence</td>
<td>10.98 (5.57)</td>
</tr>
<tr>
<td>Social Impact</td>
<td>10.30 (6.91)</td>
</tr>
<tr>
<td>Psychological impact</td>
<td>10.16 (6.94)</td>
</tr>
<tr>
<td>Aesthetic concern</td>
<td>5 (3.53)</td>
</tr>
<tr>
<td>Anxiety (trait)</td>
<td>18.14 (9.73)</td>
</tr>
<tr>
<td>Self-esteem</td>
<td>22.14 (4.72)</td>
</tr>
<tr>
<td>Self-efficacy</td>
<td>31.88 (3.83)</td>
</tr>
<tr>
<td>Negative affect</td>
<td>20.02 (7.30)</td>
</tr>
<tr>
<td>Positive affect</td>
<td>33.44 (7.02)</td>
</tr>
</tbody>
</table>

Note. Data are presented as (%) or mean (SD).

Criterion variable: Affect. Affect refers to psychic experiences and emotions we experience. The positivity or negativity that define affect involve hedonic tone (pleasant or unpleasant) of the experience. Affect reflects our reaction to almost any experience or life situation. It is one of the platforms on which people make their more global evaluations about their well-being (Kahneman, 1999). It includes both relatively transient reactions linked to identifiable physiological states (what we call emotions) as well as more diffuse and permanent states that stain our affective experience continuously (so-called moods).

We used the Positive and Negative Affect Scale (PANAS; Watson et al., 1988) to assess affect. The PANAS has been widely used and validated across different languages and samples (i.e. English, Chinese, Croatian, Gujarati, Spanish, and Japanese; Leue & Beauducel, 2011).

This scale is composed of two factors (10 items, each factor on a five-point scale ranging from ‘very slightly or not at all’ to ‘extremely’), one assessing positive affect (PA) and the other negative affect (NA).

PA reflects the extent to which one is experiencing a positive mood (items of the PA scale: active, alert, attentive, determined, enthusiastic, excited, inspired, interested, proud, and strong). High PA represents a combination of Pleasantness and Activation.

NA reflects the extent to which one is experiencing a negative mood (items of the NA scale are afraid, ashamed, distressed, guilty, hostile, irritable, jittery, nervous, scared, and upset). High NA represents a combination of Unpleasantness and Activation.

In this model, the upper level reflects the valence of the items (i.e. positive or negative emotional states), and the
lower level reflects the specific content (i.e. the qualities of emotional states).

The difference between PA and NA is called affective balance.

Another particularity of the PANAS is the idea of conceiving mood not only as a momentary but as a longer lasting state by the application of different time frame instructions (Watson et al., 1988). In our study, the instructions were aimed at assessing the affect linked to the circumstance of being under orthodontic treatment.

**Predictor variables**

**Dental impact perception.** Dental impact perception was assessed using The Psychosocial Impact of Dental Aesthetics Questionnaire (PIDAQ; Klages et al., 2006), which is a 23-item instrument that uses a five-point Likert scale ranging from 0 to 4 (0 indicates not at all; 1: a little; 2: somewhat; 3: strongly; and 4: very strongly). It evaluates four domains: dental self-confidence (six items), social impact (eight items), psychological impact (six items), and aesthetic concern (three items). The PIDAQ instrument has been previously tested for its validity, reliability, and factorial stability across samples (Klages et al., 2006; de Paula et al., 2009; de Paula et al., 2011).

**Self-esteem.** Rosenberg’s self-esteem scale (Rosenberg, 1965) was used to assess self-esteem. Rosenberg’s scale is a 10-item dimensional instrument with a Likert scale in which a positive or a negative response is weighed with a four-point scale, ranging from ‘strongly agree’ to ‘strongly disagree’, resulting in a scale of 0–30 points. This scale has been used many times with proven reliability and validity for the general population and orthodontic patients (Jung, 2010; Nicodemo et al., 2008; Vaida et al., 2009).

**Self-efficacy.** The General Self-Efficacy (GSE) Scale (Schorzer and Jerusalem, 1995) is a 10-item psychometric scale that is designed to assess GSE, which is defined as the belief in one’s competence to tackle novel tasks and to cope with adversity in a broad range of stressful or challenging encounters. Possible responses weighed in a four-point Likert scale, resulting in a scale of 10–40 points. This scale was developed for use in several cultures with internal consistencies between 0.84 and 0.91. The unidimensional nature of the scale was replicated in all samples (Schorzer et al., 1997).

**Anxiety (Trait anxiety).** The Trait Anxiety Scale from State-Trait Anxiety Inventory (STAI; Spielberger et al., 1983) was used to assess trait-anxiety. The STAI allows assessment of two distinct anxiety concepts: state anxiety (how one feels at a particular moment; e.g. dental visit) and trait anxiety (how one usually feels). Each of the two scales consist of 20 items, using a five-point Likert scale ranging from 0 to 3 (0 indicates rarely; 1: sometimes; 2: often; 3: almost always), resulting in a scale of 0–60 points. This instrument has been used extensively to measure anxiety in orthodontics research (Trakyali et al., 2009; Sari et al., 2005).

Trait anxiety was used as it is considered to be a relatively stable personality variable and so as to be able to assess its predictive role on affect associated with orthodontic treatment. Also, given the importance that this variable has shown, we were interested to control its weight and to be able to assess the effect of the other psychosocial variables taken into account.

Socio-demographic data were gathered using a questionnaire designed by the research team, which included information about age, gender, relationship status, educational level, socio-economic level, and employment status at the time of the study.

**Procedures**

The study was carried out between September 2010 and January 2012. Once a patient started orthodontic treatment, a dentist and a psychologist, who were part of the research team, established contact with the participants personally at the dental clinic department of the Rey Juan Carlos University Clinic. Patients were informed of and invited to participate in the study. We approached 120 eligible patients. Of these, 74 (61.6 per cent) agreed to participate in the study.

Once the patients accepted their inclusion in the study, they were given a questionnaire booklet to complete, including demographic variables and psychosocial dental impact, self-esteem, self-efficacy, and trait-anxiety measures.

Six months after initial assessment, when patients were due for a check-up, they were assessed with the PANAS questionnaire. The patient was asked to fill out the questionnaire considering the effect that the orthodontic treatment had in his/her life. All the patients (74) completed the second stage.

**Statistical analysis**

All statistical analyses were performed using the Statistical Package for the Social Sciences (SPSS), version 17.0 for Windows. We proceeded to perform descriptive analysis. To analyse the relationship between socio-demographic and target variables we proceeded to perform appropriate t-tests, analysis of variance or Pearson correlations, depending on the nature of the variable. The significance of post hoc comparisons was calculated with the Scheffe’ test. We used eta-squared to measure effect size (magnitude of differences), interpreted as the proportion of variance in the dependent variable that is attributable to each effect. Student’s t-test was used to compare variables between groups (high and low affect; positive and negative). The predictors of affective balance were examined with multiple linear regression analyses. All variables that could exert a
confounding effect on the regression analyses were also included (age, educational level, and gender). All results are presented as averages (SD), and differences were considered significant at a $P < 0.05$.

**Results**

**Preliminary analyses**

**Sociodemographic variables.** Having a steady partner, socio-economical level, and current working status did not associate significantly to the target variables (dental impact, trait anxiety, self-esteem, self-efficacy, and PA and NA). As for educational level, significant differences were observed regarding PA ($F(2,34) = 4.37; P = 0.029; \eta^2 = 0.20$), as significant differences were found post hoc between secondary education (27.81, SD = 10.05) and university studies (34.95, SD = 5.53). With age there are significant and positive correlations regarding social impact ($r^2=0.31, P = 0.01$). Finally, gender maintains a statistically significant relationship with self-efficacy ($t = -1.98, P = 0.049; \eta^2 = 0.06$). Specifically, men (32.93, SD = 3.93) have higher scores than women (31.10, SD = 3.61).

**Differences between groups with high and low negative and PA in the target variables.** We divided the patients in two groups (low affect and high affect), both for PA as for NA, using the median of the distribution of the respective variables as a cutoff. As shown (Table 2), there were significant differences in the case of trait anxiety for both types of affect, for PA ($\eta^2 = 0.19$), and for NA ($\eta^2 = 0.22$). This same profile was observed in relation to dental social impact, but only in relation to NA ($\eta^2 = 0.06$). Significant differences were found for self-esteem for both types of affect: PA ($\eta^2=0.15$), and NA ($\eta^2 = 0.14$). This same profile is observed in self-efficacy, but only for the PA ($\eta^2 = 0.13$). All differences found are in the expected direction.

**Psychosocial variables predictive of affective balance.** In order to determine the predictor variables of affective balance (differences between PA and NA) a regression analysis using affective balance as the dependent variable was carried out. For that, we proceeded to enter as predictor variables only those that were statistically significant with respect to the analysis of mean differences between low and high affect (positive and negative): social impact, self-efficacy and self-esteem, and trait anxiety. To control the possible effect of socio-demographic variables, in the first step of the regression equation socio-demographic variables that were statistically significant were introduced as the variables of interest: gender, age, and educational level. The regression analysis shows that the only predictor variable is trait anxiety ($b = -1.014, t = -4.5, p < 0.01; F = 6.37, p < 0.01; R^2 = 0.68$). Therefore, to determine the predictive role of the other psychosocial variables, we proceeded to perform a second regression analysis, excluding trait anxiety. The results show (see Table 3) that self-esteem is the only variable maintaining a statistically significant relationship with the affective balance.

**Table 2** Differences in trait anxiety, dental impact, self-efficacy and self-esteem for the low and high affect (negative and positive) groups.

<table>
<thead>
<tr>
<th></th>
<th>Negative affect</th>
<th>Positive affect</th>
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<tbody>
<tr>
<td></td>
<td>Mean (SD)</td>
<td>Mean (SD)</td>
</tr>
<tr>
<td></td>
<td>Low affect</td>
<td>High affect</td>
</tr>
<tr>
<td>Anxiety (trait)</td>
<td>13.87 (7.86)</td>
<td>22.90 (9.58)</td>
</tr>
<tr>
<td>Dental self-confidence</td>
<td>11.10 (5.81)</td>
<td>10.75 (5.84)</td>
</tr>
<tr>
<td>Social impact</td>
<td>8.86 (3.59)</td>
<td>12.25 (7.88)</td>
</tr>
<tr>
<td>Psychological impact</td>
<td>9.21 (4.68)</td>
<td>11.51 (8.83)</td>
</tr>
<tr>
<td>Aesthetic concern</td>
<td>4.94 (3.34)</td>
<td>5.39 (3.70)</td>
</tr>
<tr>
<td>Self-efficacy</td>
<td>32.48 (4.04)</td>
<td>31.06 (3.58)</td>
</tr>
<tr>
<td>Self-esteem</td>
<td>23.66 (3.85)</td>
<td>20.16 (5.03)</td>
</tr>
</tbody>
</table>

**Table 3** Regression analysis for affective balance (DV: Dependent Variable).

<table>
<thead>
<tr>
<th></th>
<th>$F$</th>
<th>$R^2$</th>
<th>Inc$R^2$</th>
<th>Beta</th>
<th>$t$</th>
<th>$P$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Step 1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Gender</td>
<td>-0.028</td>
<td>-0.150</td>
<td>0.881</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Age</td>
<td>-0.135</td>
<td>-0.668</td>
<td>0.509</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Step 2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Social impact</td>
<td>-0.056</td>
<td>-0.287</td>
<td>0.776</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Self-efficacy</td>
<td>0.239</td>
<td>-1.181</td>
<td>0.248</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Self-esteem</td>
<td>2.684*</td>
<td>0.383</td>
<td>0.350</td>
<td>0.430</td>
<td>2.339</td>
<td>0.027</td>
</tr>
</tbody>
</table>

Standardized regression coefficients (betas) are derived from the step in which they are added to the equation.

Step 1: gender (0: women, 1:men), educative level (0: primary and secondary education, 1: higher education).

*P < 0.05; **P < 0.01.
predictor variable of affective balance in patients undergoing orthodontic treatment. The whole model explained 38 per cent of the variance in affective balance.

**Discussion**

This study analyses the influence of certain psychosocial variables on the affect of patients undergoing orthodontic treatment.

Regarding trait anxiety, our results fall into the 40–50 percentile, indicating moderate anxiety levels (Spielberger et al., 1983), consistent with findings of Alanko et al. (2010) who did not detect psychiatric emotional profiles in patients undergoing orthodontic treatment.

Regarding PIDAQ, the scores on dental self-confidence are similar to the results obtained in other studies, as much among non-clinical and adolescent samples (de Paula et al., 2009) as in a sample of adults seeking orthodontic treatment (Gazit-Rappaport et al., 2010). As for the other dimensions, social impact, psychological impact, and aesthetic concern, scores observed in our study are higher than those found in previous studies in adult patients seeking orthodontic treatment (Gazit-Rappaport et al., 2010; Wright et al., 2010).

Self-esteem level is similar to that found in other studies in non-clinical population (Baños and Guillén, 2000), and in studies that assess the effects of malocclusion and orthodontic treatment on self-esteem with the use of the same instrument (Jung, 2010).

Patient’s anxiety (trait anxiety) is a variable clearly related to affect, both NA and PA. The importance of trait anxiety as a variable that will affect the success of treatment and patient satisfaction with it, has been reported by different authors (Sari et al., 2005; Kiyak et al., 1985). However, the psychosocial variables associated with PA are different from those associated with NA. Thus, while self-esteem is related to both types of affect, self-efficacy is an additional key variable in the differentiation between patients with high and low PA, whereas social impact is a key additional variable in the differentiation between patients with high and low NA. Therefore, the increase of self-esteem and the decrease of social impact are key to reduction of NA, consistent with results found in other studies (Phillips and Beal, 2009; Birkeland et al., 1996), but if we also want to generate positive emotions we must work also on patients’ self-efficacy. Self-efficacy has particular interest, not only because it is linked to positive emotions and not to the reduction of NA but because it is a variable hardly considered in the orthodontic context. Increased patient compliance in specific interventions focused on educating and motivating patients to maintain their oral health and providing recommendations or dispensing home care tools (Levin, 2004) could be explained by an increase in patient’s self-efficacy, although this variable was not assessed explicitly in Levin’s work.

This study has some limitations that may curtail the generalization of results. The convenient nature of the sample, composed of voluntary patients recruited through the Rey Juan Carlos University Clinic, may limit its representativeness, and thus limit the generalization of these findings to general population. Also, even though this study is prospective, its duration is limited to 6 months, and more assessments may be needed till the end of treatment. After 6 months of treatment, 100 per cent of patients are still under treatment, so additional temporal measures would be needed to assess if affect is actually related to treatment adherence.

These findings have important practical implications. One is the modification of affect through psychosocial variables associated to it (especially self-esteem and self-efficacy), given the role of these variables in predicting both emotional balance and PA differentiation. Although trait anxiety plays a fundamental role, previous literature highlights the difficulty of reducing it through the techniques that have been normally used in orthodontic treatment which do not always have the desired effect, such as to provide additional information in writing (Wright et al., 2010) or the use of relaxation techniques. Therefore, given the difficulty of working with trait anxiety, another possibility is to work on self-esteem and self-efficacy. These variables have been subject to successful intervention in numerous health problems through cognitive-behavioral therapy (CBT).

Given the adverse effects of the presence and inadequate management of negative emotions on the outcome of orthodontic treatment documented with specific cases (Davidovitch and Krishnan, 2008), it seems essential to adopt an interdisciplinary approach (Agou et al., 2011). From a bio-psychosocial perspective, the inclusion of these variables in orthodontic treatment, contributes to reducing patient’s negative emotions and improving patient’s positive emotions, and therefore the adherence to orthodontic treatment (Sari et al., 2005), and the adjustment of expectations and emotional regulation that ultimately improve overall treatment results.

Similarly, as evidenced Alanko et al. (2010), the inclusion of emotional variables should not necessarily include a psychopathological perspective but instead should incorporate assessment methods, as is the case of PA and NA used in this study, that focus on day-to-day changes in mood and well-being.

**Conclusion**

It seems essential to adopt a bio-psychosocial model with assessment methods focusing on day-to-day changes in mood and well-being, incorporating certain relevant psychosocial variables such as self-efficacy and self-esteem. Certain interdisciplinary approaches based on CBT, can improve the affect associated with orthodontic treatment through the intervention on the above variables.
References


