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Symptoms, Clinical Characteristics and Consequences
Magnus Hakeberg and Jesper Lundgren

Introduction

This chapter will discuss the underlying factors concomitant with dental fear and anxiety and dental phobia and how such different symptoms interact in the maintenance of the irrational fear and possible future consequences. In the text fear and anxiety will be used interchangeably. However, phobia has another grading, which is related to the definition according to DSM-IV, and will not be interchanged with other terms.

The phenomena of dental anxiety, where individuals typically show different signs and symptoms related to dental care, have been revealed to be similar, irrespective of country, culture and other living conditions (Armfield, Spencer and Stewart 2006; Hakeberg, Berggren and Carlsson 1992; Milgrom et al. 1988; Moore et al. 1993; Neverlien 1990; Stouthard and Hoogstraten 1990).

The prevalence of high dental anxiety ranges between 3 per cent and 10 per cent depending on measurement methods and sample selections. Moreover, since the first scientific reports on the epidemiology of dental anxiety it seems that it is as common today as it was 40 to 50 years ago (Armfield et al. 2006; Freidson and Feldman 1958; Hakeberg et al. 1992; Milgrom et al. 1988; Moore et al. 1993; Neverlien 1990; Stouthard and Hoogstraten 1990). We may ask why the prevalence has not changed during this period of time despite the continuing progress of dental care. Greater awareness of the problem, technological advances and better undergraduate curriculum and postgraduate education should possibly have decreased the prevalence of dental anxiety. One answer may be that the majority of the group of individuals with moderate dental anxiety has become less anxious. Several scientific reports indicate such a development when comparing cohorts over time in repeated cross-sectional studies (Hägglin 2000). However, there are still individuals who are highly fearful of dental care and procedures. These persons report that being highly fearful or even phobic
of dental care affects their life situations in many different ways. This chapter introduces the major symptoms related to high dental anxiety or dental phobia.

Since the 1970s a large amount of research literature has shown that individuals with reported dental anxiety and phobia are also affected by different negative manifestations and consequences related to physiological, psychological and social aspects of their health and life situations. In such a perspective we may relate to Carlsson and Jern’s (1982) theoretical model, which describes a specific causal theory and a paradigm shift concerning the relationship between biological, psychological and social factors (Figure 1.1). They suggested a systems-oriented multi-causality model where different factors interact in the development of a disease. It is assumed that social, psychological and physiological components are in constant interaction with each other, leading over time to psychological, social and somatic changes. Such changes affect the successive interaction.

The vicious circle of dental anxiety

Applying this perspective to dentistry, Berggren presented a model that describes several components of the effects from severe dental anxiety resulting in the establishment of a vicious circle (Berggren 1984; Berggren and Meynert 1984). Such a vicious circle, or rather vicious cycle, since time is an important component in the development of disease and illness, is shown in Figure 1.2. A person’s initial fear and anxiety may lead to an avoidance of or irregular dental care. This can mean irregular dental visiting habits with only emergency dental treatments, or even total avoidance. If necessary treatment is not carried through then oral health may be affected negatively, for example, with the development of carious lesions in the teeth as well as a progress of periodontitis. Thus, deterioration of the oral status starts to progress, causing the individual to be aware of the effects on their oral health. Not being able to carry through with regular dental care and treatment may further initiate feelings of inferiority, shame and embarrassment about the situation and for a dentally anxious individual such feelings may over time give rise to obvious social problems in daily life situations such as during contact with people at work, with friends or relatives and/or at home within the family. With time, this pattern of effects may lead to higher and more widespread anxiety of dentistry and eventually less regular dental care or even avoidance of dental treatment.
Measurements of dental anxiety

Dental anxiety may be seen as a phenomenon measured on a continuum, from no anxiety to extreme anxiety. Several different measurement scales have been used in scientific studies. Global, single-item questions are frequent, via a visual analogue scale (VAS) and verbal rating scales using a Likert format (Hägglin et al. 1999; Milgrom et al. 1988; Pohjola et al. 2009). However, multiple item scales such as the Dental Anxiety Scale (DAS) (Corah 1969), the Modified Dental Anxiety Scale (MDAS) (Humphris, Morrison and Lindsay 1995), the Dental Fear Survey (DFS) (Kleinknecht and Bernstein 1978) and the Dental Anxiety Inventory (DAI) (Stouthard, Hoogstraten and Mellenbergh 1995) are applied more often. Armfield (2010a) has published a new measure of dental fear (Index of Dental Anxiety and Fear, IDAF-4C+) based on DSM-IV specific phobia categories and of emotional, behavioural, physiological and cognitive components of the anxiety and fear response. Although the IDAF-4C+ is promising, only a few studies have used the measure, implicating the need for obvious psychometric testing concerning reliability and validity in different samples of specific and general characters. Multiple item scales are often used with a cut-off value to identify highly dentally anxious subjects. Among other things, one problem with the analyses which use a transformation of a scale to dichotomize a variable after a specific value is that information about subjects may be lost. In addition, the scaling of the tests sometimes infers ceiling and/or floor effects which may hamper the interpretation of how anxious individuals really are. Such methodological aspects are important when analysing characteristics and consequences of dental anxiety among patients or individuals.

Another issue that should be taken into account is the differences between the subjects included in the scientific reports on dental anxiety. Generally, two different sample selections have been used in the research designs. Firstly, clinical samples of highly dentally anxious individuals or dental phobic subjects have been included in experiments using different treatments for dental anxiety. Typically, different aspects of negative effects of dental anxiety have been reported in these studies, but subjects have more or less also avoided dental care completely or nearly completely for a longer period of time. Thus, such clinical samples may describe a narrower effect of dental anxiety on negative consequences, such as health and psychosocial effects. Subjects attending special clinics for the treatment of high dental anxiety or dental phobia with avoidance behaviours of ordinary dental care usually show important and negative impacts on health and psychosocial consequences. However, when examining subjects randomly selected from the general population, who report high dental anxiety or dental phobia,
the effects on health and psychosocial consequences show a wider spectrum with regard to these outcomes. This difference, is important to bear in mind when evaluating the symptoms, characteristics and consequences of dental anxiety due to the selected study sample. Having said this, this chapter will illuminate both types of study sample selections and associated impact on health and psychosocial factors.

Symptoms, Characteristics and Consequences of Dental Anxiety and Dental Phobia

The different symptoms, characteristics and consequences of dental anxiety, dental phobia and injection phobia (IP) are described below with regard to oral health, dental attendance behaviours, psychological and physiological factors. The effects of dental anxiety described in this chapter use the theoretical model of Berggren’s vicious circle; and results from both clinical and observational studies will be shown to exemplify important factors associated with the phenomena of dental anxiety.

Avoidance of dental care

Avoidance of dental care and treatment is usually a strong predictor of high dental anxiety. Individuals with dental phobia are, according to the defined criteria of phobia in DSM-IV, avoiders of dental care. However, in both clinical samples and observational studies there is a variability in the degree of avoidance behaviour. The measurement of dental attendance is mostly by self-reported data by the subjects, and concerns the last visit to a dental clinic or frequency of regular visits to a dental clinic (Armfield et al. 2006; De Jongh, Schutjes and Aartman 2011; Hägglin 2000; Pohjola et al. 2009). These measures vary in different studies, albeit there is reasonable congruence between reports. In general, there is an abundance of data supporting the association between high dental anxiety or dental phobia and irregular dental visiting habits regardless of culture and country. In an attempt to describe different categories of dental visiting habits, Milgrom discussed individuals’ level of dental anxiety and choice of regular dental care via an approach–avoidance conflict to dental care (Milgrom 1985). Four types of patient categories were allocated. Firstly, subjects that feel low to moderate dental anxiety have regular dental care. Secondly, moderate to high dentally anxious subjects visit the dentist on a regular basis and may, according to Milgrom (1985), be characterized as ‘goers but haters’. However, individuals in both of these categories may be vulnerable in the sense that they probably can change their visiting patterns to the dentist. Why and what factors can change the balance to more avoidance are not clarified, but speculation may include a negative treatment experience such as extreme or unexpected pain, or more cognitive aspects such as poor communication between the care-giver and the patient. Despite their regularity of dental care, patients in these categories may benefit from specific dental anxiety treatment, so as to alleviate their vulnerability to a change in dental visiting habits. The third category includes patients with high dental anxiety or possibly border dental phobia and are partial avoiders. Such individuals may accept emergency treatments and sometimes conventional dental care, but on an irregular basis. Finally, the last category includes subjects that have full avoidance behaviour of dental care, i.e. they do not go to the dentist at all.
**Clinical studies**

Internationally there are a few specialized clinical centres that have been organized and characterized by both patient treatments and clinical research. The clinics have different experiences depending on when and where they were established. However, these clinics are and have been using a referral system for patients and thereby have described systematically the patients with regard to their high dental anxiety levels and importantly, their inability to tolerate conventional dental treatment. In addition, the patients are mostly characterized by avoidant behaviour to dental care indicating irregular visiting habits. Among these clinics are centres in Gothenburg, Sweden; Bergen, Norway; Amsterdam, Netherlands; and Seattle, USA. These research centres have had a large and important impact on the development of treatments for dental anxiety, the knowledge of how and to what extent factors concomitant to dental anxiety and phobia develop over time and their impact on patients’ life situations. Avoidance behaviour of dental care associated with dental anxiety is clearly one of several important factors that research at these centres has been able to document. Keeping in mind that the patient groups have been and are special with regard to levels of dental anxiety and phobia, the range of avoidance time for dental care is estimated between 5 and 20 years among extremely dentally anxious patients or dental phobic individuals as reported from a variety of clinics and there is a clear and significant association between level of dental anxiety and length of avoidance (Aartman et al. 2000; Abrahamsson et al. 2003, Berggren 1984, De Jongh et al. 2011; Hakeberg et al. 1992; Moore, Brodsgaard and Birn 1991). A history of missed and cancelled dental appointments may be a reliable source to investigate if a person exhibits dental fear reactions. Avoidance of dental care plays an important role in escalating the manifestations and consequences of dental fear. It affects the level of dental fear, the magnitude of psychosocial effects and certainly most often the dental status (Berggren and Meynert 1984). For a majority of individuals with dental anxiety and an avoidance behaviour of dental care the deterioration of their dental health may progress over time at a different pace, but their awareness of the problem is definitely at hand and the size of the problem may also become a stigmata. Social pressure from surrounding family and friends and support may for some individuals reduce the level of avoidance (Berggren and Meynert 1984). Such pressure and support may also include other ways to conclude, e.g. dental care through treatment under general anaesthesia or sedation, thus using more expensive dental care.

**Observational studies**

There are many scientific publications during the past decades that show a statistically significant correlation between dental anxiety and avoidance of dental care among subjects in the general population (Hakeberg et al. 1992; Hägglin et al. 1996; Locker, Liddell and Burman 1991, Moore et al. 1993; Vassend 1993). Such associations are found both with regard to last visit to a dentist and regularity of dental visiting habits. Moreover, it has been shown that this relationship has a gradient, indicating that the higher the level of dental anxiety the longer the time of avoidance (Locker et al. 1991).

**Oral health among individuals with extreme dental anxiety**

**Clinical studies**

Surprisingly, the effects and consequences of severe dental fear and an avoidance behaviour on individuals’ dental status have not been established thoroughly in earlier research, maybe due to an empirical and an expected obvious relationship.
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Berggren and Meynert (1984) found in a group of extreme dental fear patients that the oral status was more deteriorated, with respect to decayed surfaces, missing teeth, apical lesions (mean number 37, 5, 4, respectively) and periodontal disease (on average, marginal bone loss $\leq \frac{1}{3}$ of the root length), than would be expected in ordinary dental patients of similar age group. This study did not include a non-anxious comparison group. Hakeberg et al. (1993) investigated the oral health in a group of patients with extreme dental anxiety and an avoidance behaviour of dental care. A control group of ordinary patients with regular visiting dental habits and accepting conventional dental treatment procedures were matched according to age, gender, marital status and housing standard and included in the analysis. The results of the study described a substantial difference in oral status between the groups. There were significantly more missing teeth, higher frequency of caries, apical periodontitis and proximal periodontitis among patients with dental anxiety (Table 1.1). However, the numbers of restored tooth surfaces were significantly fewer among the dentally anxious individuals.

In a similar dental fears clinic in Bergen, Norway, Agdal et al. (2008) examined dental phobic patients according to DSM-IV criteria with regard to their oral status. The patients ($N=40$) had extreme dental anxiety and had avoided dental care on average for 11.2 years. Mean missing teeth was about 2 ($SD=3.5$) and the mean number of teeth with caries was 6.7 ($SD=4.3$). There were differences between the above two studies, however, the oral status is clearly highly affected with regard to several measures on oral health and diseases. Patients attending special clinics for dental fear on a referral basis do have poor oral health and since the avoidance is a feature of the dental anxiety complexity there is a gradient of oral status with age. The older the patient the more worse the oral status is, as compared to younger individuals. Wide Boman et al. (2010) used a single group design with referred dental phobic patients who were examined with respect to their oral health. Results were similar to those in the previous studies with 3.4 ($SD=4.0$) and 8.1 ($SD=5.2$) for the mean number of missing teeth and decayed teeth, respectively. In the studies by Agdal et al. (2008) and Wide Boman et al. (2010) another outcome was analysed, namely the presence of root remnants. Such a feature may indicate a long-term period of avoidance of dental care and lack of a drive to even consider emergency treatment. In the Agdal et al. study nearly 40 per cent of the sample had one or more root remnants, while the figure was 57 per cent in the Wide Boman et al. study.

Table 1.1 The difference in oral status in a clinical study (Hakeberg et al. 1993) including a group of dental phobic patients ($N=90$) and a group of ordinary dental patients ($N=90$). Mean numbers and standard deviations are displayed.

<table>
<thead>
<tr>
<th>Oral status</th>
<th>Dental anxiety group</th>
<th>Control group</th>
</tr>
</thead>
<tbody>
<tr>
<td>Missing teeth</td>
<td>4.4 (4.9)</td>
<td>2.5 (2.9)</td>
</tr>
<tr>
<td>Caries (surfaces)</td>
<td>19.5 (11.1)</td>
<td>7.9 (5.3)</td>
</tr>
<tr>
<td>Apical periodontitis</td>
<td>4.0 (4.7)</td>
<td>1.2 (1.6)</td>
</tr>
<tr>
<td>Marginal periodontitis (no. of tooth surfaces &gt;4 mm)</td>
<td>5.0</td>
<td>1.0</td>
</tr>
<tr>
<td>Filled surfaces</td>
<td>8.1 (6.4)</td>
<td>13.1 (9.1)</td>
</tr>
</tbody>
</table>
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Observational studies

In general, epidemiological studies reveal an obvious relationship between oral status and dental anxiety. Individuals with dental anxiety have more oral diseases than non-dentally anxious persons. In addition, studies also point towards a gradient in health inasmuch as the higher the dental anxiety levels the more negatively affected the oral health (Hällström and Halling 1984; Hägglin et al. 1996; Ng and Leung 2008). The differences are not typically large due to certain factors as compared to the clinical studies mentioned above. Thus, the fact that both dentally anxious individuals with or without regular dental visiting habits are included in these reports make a difference with regard to the oral status. Another possible explanation may be that subjects who have a phobia for dental care do not participate in epidemiological studies with the objective to examine oral health and diseases as well as being asked about their dental care behaviours and so forth. Such individuals could certainly belong to a non-participation or dropout group.

Some studies of observational character only reveal self-reported oral health in relation to dental anxiety levels. These publications also show a strong correlation between poor oral health and high dental anxiety even after adjustment for other potential risk factors and confounders (Meng et al. 2007; Pohjola et al. 2009). Also, other significant problems in relation to oral health such as toothache, gingivitis and chewing problems were more common in highly fearful individuals (Milgrom et al. 1988). The results in studies of individuals’ self-reported estimates of their own oral health should, however, be interpreted with some caution with respect to actual oral status, since highly dentally anxious subjects may over report the deterioration of their oral health (Moore 1991).

Associations between dental anxiety and oral status have been indicated in a substantial number of epidemiological surveys. The majority of publications have a cross-sectional design while only a few reports have conducted longitudinal analysis. In one study from the 1970s by Lavstedt (1978) it was found that several oral health variables were affected by the degree of dental anxiety reported. It was shown that, in comparison with ordinary dental patients, subjects with dental anxiety on average had higher frequencies of missing teeth, caries, endodontically
treated teeth and a higher degree of marginal alveolar bone loss. Furthermore, women with dental fear were found to have more decayed surfaces and fewer filled surfaces compared to women with no dental fear. However, the reliability and validity of the measurements of dental anxiety was not clear in this study.

In a representative sample of middle-aged women, Hällström and Halling (1984) found that individuals with pronounced dental phobia had significantly more missing teeth and more marginal alveolar bone loss compared to women with no or low degree of dentistry phobia. Cohen (1985) reported on the association between dental anxiety and DMFS (Decayed Missing Filled Surfaces) status within a US naval population. It was found that male recruits with reported high dental anxiety had significantly more decayed surfaces than low anxious recruits. No significant differences were found with regard to missing or filled surfaces. It should be pointed out that the mean age of this single-sex population was low, with a relatively low rate of caries, which may be why differences in dental health have not emerged in full. In a study from Norway (Schuller, Willumsen and Holst 2003), the association between dental fear as measured by the Dental Anxiety Scale and several indicators of oral status was investigated. The authors found that dental fear was significantly correlated with higher number of decayed surfaces, decayed teeth and missing teeth; and a lower number of filled surfaces, filled teeth, functional surfaces and functional teeth. However, there were no significant differences with regard to the DMFT (Decayed Missing Filled Teeth) and DMFS indices and degree of dental fear. One conclusion of this report must be that since the separate parts of the indices methodologically counteract each other in relation to the outcome, different measures should be used while analysing the oral status among dentally anxious individuals. The aspect of functional teeth or surfaces is interesting since it reflects the number of filled and sound teeth which may be perceived as the ability to chew (function) and an aesthetical dimension (appearance). Moreover, the study had good external and internal validity with a large sample size and used reliable measurements indicating an important impact of dental fear on the oral health status.

In a large epidemiological and cross-sectional national survey in Finland, Pohjola et al. (2008) analysed the relationship between dental fear and dental conditions among over 6000 adult individuals. All dental health variables used in this study were significantly associated with high dental fear except number of restored teeth. The authors also revealed that there was a gradient between the number of decayed teeth and the odds ratio of having high dental fear. So, the odds ratio was 1.1 per decayed tooth for the outcome high dental fear, meaning that a person having 10 decayed teeth would have about 11 times higher risk of being highly fearful of dental care. This finding, according to the regression models, was estimated irrespective of age, gender, dental attendance and any interaction terms entered in the statistical model. Similar results were presented for the number of missing and sound teeth, albeit this association was age modified in a specific pattern. Typically, the younger a person the fewer teeth missing and the higher the dental fear. This correlation was reversed the older the individuals were. These findings may be interpreted as strange, but considering that highly fearful individuals avoid dental care during adolescence and young adulthood then dental treatment with extractions of teeth is less common as opposed to less fearful persons. Reasons for removal of teeth in that age group may of course be of orthodontic diagnosis and trauma. However, the older the individual, the higher the risk for longstanding caries lesions and eventually extraction of teeth. Such a development may be possible for individuals with high dental fear and irregular dental visiting habits and may explain the results in the study by Pohjola et al. (2008).
Another issue concerning oral health status among dentally anxious individuals is a possible gradient in level of dental anxiety related to a gradient in deteriorating oral status. A few scientific publications point towards such a relationship. Ng and Leung (2008) investigated the role of the degree of dental anxiety and effects on decayed, missing and filled teeth as well as periodontal disease as measured by the clinical attachment level (CAL) in a cross-sectional survey performed on 1000 adults living in Hong Kong. Their findings present a clear and significant relationship between level of dental anxiety and level of disease or status, the higher the dental anxiety the more affected negative oral status, even regarding periodontal disease. These results were modelled with regression analyses including adjustments for age, sex, smoking, education and income. However, as noted in previous studies, the number of filled teeth had an inverted relationship with fewer fillings in higher levels of dental anxiety. In a study from Australia, Armfield et al. (2009) presented data from a large cross-sectional, nationwide sample (N=5364) of adults concerning the association between dental fear, dental caries and periodontal indicators. Parallel results to Ng and Leung (2008) were found, but in contrast to the previous study Armfield et al. (2009) did not reveal a correlation between periodontal indices of clinical attachment level (severe-moderate periodontitis) or gingival index (gingivitis) and level of dental fear.

Some studies have used subjectively reported oral health in relation to dental anxiety. In general a clear majority of surveys find significant associations between dental anxiety and a poor self-perceived oral health. For example, Meng et al. (2007) evaluated in a telephone survey of adult individuals in Florida, USA the relationship between self-rated overall oral health and high/low fear and found an odds ratio of 0.43 (p=0.004) for the likelihood of having a good oral health, meaning that there was a statistically significant risk for high fear individuals to experience a poor self-perceived oral health. Pohjola (2007) showed in a logistic regression analysis model that perceived poor oral health and perceived dental treatment need were significant predictors of high dental fear with odds ratios of 2.0 and 2.3, respectively. In a further age-specific model it was revealed that the only age group that had perceived poor oral health in relation to high dental fear included individuals of 30–34 years of age. The other variable perceived treatment need was significant in the older age groups. These findings may indicate that younger dentally anxious individuals are more uncertain as to how their oral status actually is with regard to several aspects such as caries and periodontal disease, while a greater experience of one’s own health and the ‘true’ status may be something that increases with age.

Psychosocial effects
As indicated by several studies another aspect of the consequences of dental fear and avoidance is the psychosocial effects that are seen among fearful dental individuals. The general opinion may be that for individuals with dental anxiety and possible irregular dental visiting habits only the oral health is affected. However, research has indicated other aspects and effects associated with dental anxiety, such as increased medication, abuse of alcohol and tranquilizers, low self-confidence and self-esteem, psychosomatic disorders and sick-leave from work (Berggren and Carlsson 1986; Berggren and Meynert 1984; Hakeberg et al. 1993; Locker 2003; Wide Boman et al. 2010).

Clinical studies
In a treatment study of severe dental anxiety patients at a specialized dental fears research and treatment clinic, Berggren and Meynert (1984) reported that a large proportion of the patients revealed feelings of negative appearance and active social withdrawal due to their estimated
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deteriorated dental health. Thus, a more holistic perspective on dental anxiety and the effects on quality of life and health has been the object of some recent investigations. For persons with a history of avoidance of dental treatment for many years, reduction of dental anxiety and a normalized dental care behaviour may have important implications beyond actual benefits in dentistry. Berggren and Carlsson (1986) reported from a clinical treatment study of dental anxiety patients different positive side effects from specific treatments that reduced their dental anxiety. The patients stated less headaches and stomach problems and that they had decreased the abuse of alcohol and sedatives. The effects were significant, albeit more so with regard to the behavioural therapy compared to treatment under general anaesthesia. Hakeberg and Berggren (1993) showed that successfully treated dental anxiety patients significantly reduced their number of sick-leave days from work from before to after treatment. Berggren (1993) conducted a study on the psychosocial effects from dental anxiety in over 100 adult dental patients with avoidance behaviours. It was found that the patients reported a range of negative social life effects. Individuals who had avoided dental care for a longer period of time (>10 years) revealed more problems than did short-term avoiders. As measured by the Nottingham Health Profile the extreme dental anxiety patients in that sample scored high on the dimensions of emotional reactions and daily life effects. A majority had restricted their relations to other people, for example meeting friends only at work or in private, and even in their family situation. Also, feelings like loneliness or isolation, easily being upset and losing temper were prevalent in this group of patients.

According to the theoretical model of the vicious circle of dental anxiety patients have feelings of inferiority and embarrassment of their oral status and the non-ability to withstand regular dental care. Wide Boman et al. (2010) demonstrated these phenomena in a group of patients referred to a special dental fears clinic. The patients reported both negative emotional and social consequences due to their extreme dental anxiety. Effects revealed were that dental anxiety made them angry, ashamed and depressed. The social effects were interference with family relationships, intimate and friend relationships and their working life. These associations were even stronger for patients with higher scores on depression and general anxiety questionnaires.

Psychosocial effects may also be measured through oral health-related quality-of-life tests where psychological, social and physiological dimensions are captured in relation to oral health and diseases. In a clinical trial of cognitive behavioural treatment of intra-oral injection phobia patients, the authors found that quality-of-life aspects were lower among the phobic group compared to a non-clinical reference group (Agdal et al. 2011). Intra-oral injection phobic patients may in some aspects resemble dental phobic patients and the effects on oral health and life situations (Agdal et al. 2008; De Jongh et al. 1998). An important outcome of the study by Agdal et al. (2011) was that quality-of-life levels were normalized post treatment.

Observational studies

Several epidemiological surveys have investigated how dental anxiety may influence a broad variety of psychosocial dimensions. Different psychometric tests as well as single, global questions from questionnaires have been used to measure such associations. It was not until the 1990s that special targeted methods, tests or questionnaires were developed in the odonto-logical sciences to capture psychosocial or health-related quality-of-life effects correlated to oral diseases and status. One of a few longitudinal epidemiological studies of adults with high dental anxiety in relation to mental health and personality factors has been published by
Hägglin et al. (2001). Among middle-aged women the authors were able to reveal that those who reported high dental anxiety over a 24-year period reported neuroticism (higher), extraversion (lower), more psychiatric impairment and social disability as compared with individuals with low/no dental anxiety. The same research group (Hägglin et al. 2000) reported on health-related quality of life and dental anxiety in women by using a cross-sectional design. The generic test, SF-36, was used to capture general functioning and well-being, albeit not directly aiming at oral status or health. The test is widely used in clinical trials as a subjective outcome assessing general health in a multidimensional scale, e.g. pain, social functioning, emotional problems and mental health. The authors found that having dental anxiety was predictive of lower levels of SF-36, meaning that the women with dental anxiety had significantly lower scores on all dimensions of SF-36. SF-36 was also retained in multiple regression analyses which adjusted for known risk factors for dental anxiety. Thus, high dental anxiety individuals had more symptoms related to physical function, pain, perceived general health, vitality, social function, emotions and mental health. An interpretation may be that high dental anxiety is related to symptoms and feelings that challenge a person’s overall daily life situation in many aspects. However, a causal pattern cannot be inferred due to the study design. There are, however, other studies that support these findings. Locker (2003) investigated psychosocial consequences and psychological well-being (emotional health, self-esteem and morale) and their relationship to dental fear and anxiety when specifically taking into account levels of general anxiety. In general the results indicated a comorbidity of dental anxiety and high general anxiety relative to psychological well-being and psychosocial consequences in life situations. Over 93 per cent of the subjects in the study reported one or more psychosocial consequences due to their high dental anxiety. The subscales indicated experienced psychological problems (e.g. feeling foolish, being afraid of dental treatment), social relationships (e.g. *people tell me my fears of dental treatment are childish and ridiculous*), avoidance/social inhibition (e.g. *I hide my teeth when I laugh or smile and I am reluctant to meet new people because of the state of my teeth*). Moreover, dental anxiety predicted poor emotional health and psychosocial consequences up and above the significance of high general anxiety. This study implicates some very important clues to the interrelationships of dental anxiety and the consequences an individual may perceive with regard to daily life situations. The oral health and status not only plays an important role concerning functions such as chewing, but definitely a significant role of psychological and social character. These findings indicate the impact of these factors in the theoretical model of the vicious circle of dental anxiety (Berggren 1984).

The above results are strengthened by some other scientific publications such as Mehrstedt et al. (2007), Ng and Leung (2008) and Pohjola et al. (2009). The first study by Mehrstedt et al. used the Oral Health Impact Profile (OHIP-14) to assess different aspects of oral health and impacts on life situations. When comparing dentally anxious subjects with a sample from the general population, the difference in oral health-related quality of life became very obvious with large deviations in median scores, indicating a substantial impact of dental anxiety on oral health and psychosocial factors. Specifically, the effects were strong regarding symptoms and function (pain, chewing capacity), as well as stress levels, self-consciousness, embarrassment and dissatisfaction with life. The Ng and Leung (2008) study showed similar results, but in addition revealed a gradient between dental anxiety levels and effects on oral health-related quality of life. The higher the dental anxiety reported the stronger functional and psychosocial effects as measured by the OHIP-14 on the participating individuals. In a large cross-sectional, national sample of the Finnish population dental anxiety and its correlation to OHIP-14 was
analysed. Being dentally anxious was estimated to increase the risk by 1.4 times of having subjective oral impacts. The dimensions affected significantly among the OHIP-14 items were similar to the report by Mehrstedt et al. (2007), i.e. pain, psychological discomfort, psychological disability, social disability and less satisfying life situation.

These observational studies further emphasize the relationship between dental anxiety and a wide range of psychosocial consequences, but also different symptoms from the mouth directly related to the frequency of having orofacial pain and a decreased functional oral capacity such as chewing and eating.

Cognitive and physiological negative effects associated with dental anxiety/phobia

What are the typical negative effects on cognitions and physiological responses associated with dental care for highly anxious individuals? Carlsson et al. (1986) tested a group of dental phobic patients before and after standard dental examinations and either systematic desensitization or premedication with a sedative. Muscle tension (EMG), heart rate (HR) and a palmar sweat index (skin conductance resistance, SCR) were measured. The outcome of the physiological variables did not show a clear pattern, displaying both positive and negative correlations to dental anxiety scores and change of scores after treatment. Higher mean SCR scores were shown after treatment, the same pattern was acknowledged in HR while EMG was reduced. The authors conclude that there is not a generalized change in physiological reactivity in a dental situation. Note that the study only included 15 subjects thereby typically violating a type II error. Hugdahl et al. (1984) evaluated cognitive and physiological symptoms among individuals with different simple phobias, including dental phobia. The most frequent and strong reactions were an increased heart activity and muscle tension while thinking of the dental situation. Higher levels of muscle tension and heart rate in dental phobic patients during video stimulation were demonstrated by Lundgren et al. (2001, 2004). Psychophysiological reactions during video exposure were compared between 126 dental phobic patients and a control group (n=25) of non-fearful individuals (Lundgren, Berggren and Carlsson 2001) and between dental and neutral video scenes (Lundgren, Berggren and Carlsson 2004). Interestingly, the skin conductance level (SCL) was consistently, although non-significantly, higher in the non-fearful group compared to the phobic group (Lundgren et al. 2001). Lueken et al. (2011) showed that higher level of dental fear was accompanied by higher SCLs during exposure to dental videos but not to exposure of other fear-relevant content (snakes). Several studies have supported that dental phobic individuals show an increase in heart rate during exposure (Elsser et al. 2006; Johnsen et al. 2003; Leutgeb, Schafer and Schienle 2011; Lundgren et al. 2001; Mcneil et al. 1993; Schmid-Leuz et al. 2007). However, the relationship between dental phobia and heart rate is complex due to an overlap between dental phobia and blood-injection-injury (BII) phobia (De Jongh et al. 1998; Vika et al. 2008), where the later has been characterized by a diphasic response. The diphasic reaction starts with a transitory increase in heart rate and blood pressure, which is followed by a marked decrease in the heart rate and blood pressure which can lead to reductions in cerebral blood flow and eventually to fainting (Graham, Kabler and Lunsford 1961; Ritz, Meuret and Ayala 2010; Steptoe and Wardle 1988). According to the DSM-IV, which classifies dental phobia as a subtype of BII phobia, approximately three out of four patients diagnosed with BII phobia report a history of fainting in phobic situations. However, in a study by De Jong et al. (1998) only 37 per cent
of patients treated for dental phobia reported a history of fainting, which was equal to the proportion in patients diagnosed with BII phobia in the same sample. It is notable that 57 per cent of the patients with dental fear could also be diagnosed as having a BII phobia. Despite this overlap, the authors argued that dental phobia should be regarded as a separate condition, apart from BII, due to the fact that there was no significant relationship between dental fear measures and BII measures (De Jongh et al. 1998).

We know that among regular dental care visiting individuals there is a large proportion of highly dental anxiety subjects. How do these patients differ from individuals with avoidance behaviour of dental care with regard to cognitions and physiological symptoms relative to dental treatment? De Jongh et al. (1994) investigated a different set of cognitions for low and high dental anxiety subjects. The authors analysed 24 thoughts that people may have concerning dental treatments. The results showed that high anxiety patients had clear and significant higher proportions of cognitions on all but two items out of 24 possible statements. Those items were “Going to the dentist is something one simply should do” and “Do I have to wait long before it is my turn?”. Furthermore, there was a gradient in the number of negative cognitions to dental anxiety which in a regression analysis accounted for about 71 per cent of the variance, thus the more negative cognitions the higher dental anxiety.

There is a large number of studies showing that subjects with dental anxiety have negative thoughts about future dental treatment, which in turn create anticipatory anxiety and obvious physiological reactions, specifically autonomic arousal with increased heart rate, perspiration, muscle tension, nausea, gagging and even fainting (Armfield 2010b; De Jongh et al. 1994; Wardle 1984).

**Conclusion**

This chapter has discussed common and recognized symptoms, clinical characteristics and consequences that may be observed or reported by individuals with dental anxiety. Using the theoretical model of the vicious circle of dental anxiety presented by Berggren (1984) a broad range of factors with a major impact on individuals with dental anxiety has been revealed, specifically related to avoidance of dental care, deteriorating oral health, negative psychosocial effects, physiological arousal as well as negative cognitions. Berggren’s model has not been tested seriously since it was first published, but more recently two reports have analysed the concepts. Both publications have a cross-sectional design. Armfield et al. (2007) used an epidemiological survey in Australia, while the other report from the Netherlands (De Jongh et al. 2011) included individuals with diagnosed dental phobia. Armfield et al. (2007) concluded that their results were consistent with a hypothesized vicious circle of dental fear. Thus, high dental fear individuals had a pattern of more avoidance behaviour, worse oral health and more emergency treatment visits, compared to subjects with lower levels of dental anxiety, with a gradient in the frequency of problems. De Jongh et al. (2011) found support for the vicious circle of dental anxiety according to Berggren’s model to some extent, although certain paths of covariability were not found in their analyses. This may be partly due to the measurements used in the study. There is, however, one major dimension, i.e. the time axis, in the model or the successive model (Hakeberg 1992) that has not been evaluated. According to this model (Figure 1.4) the development of dental anxiety, avoidance behaviour of dental care, a deteriorating oral health and psychosocial consequences, including negative cognitions,
will continue and develop over time, unless the vicious ‘spiral’ is broken at any given time for different reasons, e.g. referral to a special clinic, major social support from family and friends or other important life events.

References


Symptoms, Clinical Characteristics and Consequences


