Review Article

Approaching Dental Anxiety: Importance, Measurement and Recent Advance in Management of the Oral Health to Systemic Disease Ecosystem

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Abstract

Anxiety is an important medical problem and the most prevalent mental illness worldwide with Dental Anxiety (DA) recognized as the 5th leading cause of anxiety. Assigning a measure of anxiety to the individual patient has resulted in a large number of scoring protocols to be developed. In this article, we review the most commonly utilized general anxiety and dental anxiety measures as well as essential data from our recently introduced PhytoDental Solutions Dental Anxiety Scale (PDSDAS). Recent results from the real world setting of the general dentist practice utilizing the Dual Dosing Full Spectrum CBD Protocol (DDFSP) indicate the PDSDAS may efficiently measure the effectiveness of anxiety modification measures. In this article, we introduce two concepts essential for advancing patient care in the dental practice. First, we point out the potential of phytocannabinoids as alternative anxiolytics capable of breaking 'The Cycle of Dental Fear'. Importantly, anxiety-related avoidance of dental care may lead not only to poor dental health but systemic disease as well. Therefore, secondly, we suggest increasing patient compliance through successful modification of dental anxiety becomes an influential factor in the 'Oral Health to Systemic Disease Ecosystem'. Finally, the dental office team of dentists, hygienists and office personnel who experience daily the stress of patients exhibiting dental anxiety in their workplace are put at risk for long-term health consequences. Implementing a plan to reduce the stress of dental anxiety will benefit the health of both the patient and their dental care providers.

Keywords: Dental anxiety; Phytocannabinoids; Anxiolytics; Dental cycle of fear; Oral health to systemic disease ecosystem; Dental anxiety scale; Modified dental anxiety scale; Generalized anxiety disorder; Hamilton anxiety rating scale; Cannabinoid; Cannabidiol; Full spectrum; Anxiolytic; t-tests; p-value; Blood oral mucosal barrier

Abbreviations

DA: Dental Anxiety; PDSDAS: PhytoDental Solutions Dental Anxiety Scale; GAD-7: Generalized Anxiety Disorder-7; HAM-A: Hamilton Anxiety Rating Scale; DDFSCBD: Dual Dosing Full Spectrum CBD; DDFSP: Dual Dosing Full Spectrum Protocol; PDSDAS: PhytoDental Solutions Dental Anxiety Scale; CBD: Cannabidiol; CBDV: Cannabidivarin; THCV: Tetrahydrocannabivarin; ANOVA: Analysis of Variance; MDAS: Modified Dental Anxiety Scale; ISI: Insomnia Severity Index; DSM-IV: Diagnostic and Statistical Manual of Mental Disorders IV; ICD-10: International Statistical Classification of Diseases and related Health Problems 10; STAI: State-Trait Anxiety Inventory; BAI: Beck Anxiety Inventory; HADS: Hospital Anxiety and Depression Scale; IDAF-4C+: Index of Dental Anxiety and Fear Survey; PD: Personality Disorder; GAD: General Anxiety Disorder; SAD: Seasonal Affective Disorder; BOMB: Blood Oral Mucosal Barrier; RETs: Randomized Controlled Trials

Introduction and Review

General anxiety

General anxiety is an emotional state which begins even before encountering the reason generating the unease. Common daily events may trigger such reactions from a wide variety of situations spanning childhood events such as starting school to situations where the adult may perceive threats in a work place environment. In nature, anxiety is associated with a fight-or-flight response; think of how horses often react to even the smallest stimuli with fear! And they're big and fast! Also, to be recognized but not dealt with here in depth is dental phobia one step beyond where the individual's anxiety becomes an unrealistic, intense fear leading to total avoidance, when possible, of the specific stimuli. Odontophobia, the irrational fear of dentistry, is listed in the Diagnostic and Statistical Manual of Mental Disorders (DSM)-IV and the International Statistical Classification of Diseases and related Health Problems (ICD)-10 [1,2].

Scoring systems for measuring general anxiety

The two most widely known and still utilized broadly scoring systems both developed to measure the severity of anxiety, mainly in outpatients, are the Generalized Anxiety Disorder-7 (GAD-7) [3,4] and the Hamilton Anxiety Rating Scale (HAM-A) [5].

GAD-7 is a seven-question, self-administered patient questionnaire that asks a patient to respond to how often they have

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been bothered by any of the seven problems over the preceding two weeks. Scoring is from 0-3 depending upon whether the response was 'not at all,' 'several days,' 'more than half the days', and 'nearly every day'. The reported sensitivity and specificity for GAD-7 to diagnose generalized anxiety is 89% and 82%, respectively. GAD-7 has also been of utility in diagnosing other common anxiety disorders including panic, social and post-traumatic stress.

HAM-A, developed in the late 1950's, was one of the first rating scales to measure the severity of anxiety symptoms. Most often rated by clinically trained individuals, HAM-A is still widely used in clinical trials as a measure of outcome. The scale consists of 14 items measured by a defined set of symptoms scored from 0-4 for each. Both psychic (mental agitation and psychological distress) and somatic anxiety (physical anxiety-related complaints) are measured.

Other notable measures of anxiety widely used include the State-Trait Anxiety Inventory (STAI) [6], the Beck Anxiety Inventory (BAI) [7] and the Hospital Anxiety and Depression Scale (HADS) [8]. These measures cover a broad range of general anxiety symptoms.

Dental anxiety

Anxiety associated with visiting the dentist has been identified as the fifth leading cause of anxiety [9]. Anxiety is a major cause of dental non-compliance effectively circumventing routine care and procedures both minor, i.e., prophylactic cleaning, and major, i.e., root canals, due to the patient's emotional state [10]. Further multiple studies have shown a direct correlation between dental anxiety and dental diseases [11,12]. A number of scales have been developed to assist both the dentist's understanding and the patient's ability to convey their anxiety/fear when visiting the dentist. The dental anxiety tools described here and employed in numerous dental offices assist in preparing for and serving the patient with anxiety.

Commonly utilized measures of dental anxiety

The Dental Anxiety Scale (DAS) consists of 4 questions about different dental situations scored from 1 (not anxious) to 5 (extremely anxious) [13]. Situations scored include how the patient feels: about going to the dentist the next day; while waiting in the office; and how they feel in the dentist's chair. This scale is used to indicate anxiety which can likely be managed or in more severe cases, including dental phobia where a mental professional's assistance is required.

The Modified Dental Anxiety Scale (MDAS) is a set of 5 questions in 5 situations focused on preparing and waiting for various situations (extraction, drilling) faced in a patient's visit to the dental office. It is a brief, self-completed questionnaire similar to the DAS but with an extra question about needle injections. The MDAS has simplified language with shortened questions for easier understanding. Each question scored in this scale is also scored from 0 to 5 [14].

The Index of Dental Anxiety and Fear Survey (IDAF-4C+) developed in response to some dentists who didn't value the simple dental anxiety scales. The IDAF-4C+ consists of three modules measuring dental fear (emotional, behavioural, physiological and cognitive); dental phobia using DSM-IV diagnostic criteria; and potential anxiety-inducing stimuli. This survey has been found useful for alerting both researchers and the general practitioner to a patient's specific fears [15].

Management of Dental Anxiety

Psychotherapeutic

Approaches to managing dental anxiety include psychotherapeutic interventions, behavioural or cognitive, pharmacological intervention of patients can be managed using either sedation or general anesthesia and in combination. Behaviour-modification therapies involve such activities as muscle relaxation and relaxation breathing, using biofeedback, hypnosis, and acupuncture, distraction, imaging and reinforcing positive behaviours. The most effective recognized dental anxiety therapy is a combination of behaviour therapy and cognitive therapy. However, there are significant numbers of patients who are not willing to undertake or respond to these types of therapy. At this point, pharmacologic therapies are an important approach to management.

Pharmacologic

Pharmacologic management through sedation can be an effective way to alleviate a patient's stress and anxiety during dental treatment, enabling work to be undertaken more comfortably. A minimal sedation can be achieved easily with an oral administration of a sedative agent most commonly benzodiazepines such as Halcion, Valium or Midazolam. However, these agents which leave the patient awake but drowsy; nitrous oxide with oxygen, or in combination with the benzodiazepines may also be used in the more anxious patient. Moderate sedation can be attained *via* the administration of multiple sedative agents with or without nitrous oxide and oxygen, or by parenteral administration of a sedative drug. For patients with significant fear or phobia, treatment utilizing the hypnotic sedative propofol may be used. Essentially, oral sedation will suppress the gag reflex, suppress pain responses, reduce anxiety, and more. However, these dental sedation methods usually last anywhere from two to eight hours after the procedure, requiring patients to have assistance in being transported to and from dental offices.

Herbs

Several systematic reviews of other herbal compounds for the treatment of anxiety and anxiety disorders have been conducted and reported including Randomized Controlled Trials (RCTs) for several agents such as ashwagandha, passionflower, galphimia, echinacea, ginkgo, chamomile, lemon balm, valerian, and lavender. Although there have been several positive studies of natural treatments for GAD, in particular with chamomile, the agent with strongest evidence for use is kava. Currently, there are ongoing clinical trials using lavender (thought to treat anxiety by inhibiting voltage-gated calcium channels) for dental and pre-operative anxiety [16,17].

Cannabis therapy

The most studied cannabinoid in anxiety is CBD. Pre- clinical animal model studies and human trials indicate that CBD is a potentially effective treatment for Personality Disorder (PD), Generalized Anxiety Disorder (GAD), and Seasonal Affective Disorder (SAD) [18]. In the study from Bergamaschi et al. [19], the authors found that the administration of a single dose of CBD (600 mg) successfully attenuated the anxiety response to a public speaking test in subjects with SAD. In another study, the same research team found that a single 400 mg dose of CBD reduced the anxiety associated with a SPECT scan in patients with SAD [20]. Most recently, the therapeutic potential of cannabidiol for the treatment of dental anxiety has also been investigated due to its anxiolytic, panicolytic and anti-compulsive properties. One report suggests that 15 mg to 30 mg of CBD applied sublingually before a dental appointment may be efficacious against dental anxiety and dental pain [21,22]. Recently

30 participants with generalized anxiety disorder were studied with 25 mg capsules of a Full Spectrum Hemp CBD. Last updated August 2021. Limited by observational study only, the investigators reported 72.5% decrease in GAD7 scores after 8 weeks of treatment. Keeping patients of SSRIs with their slow response, side effects and lack of compliance were compared to favourable improvements seen in some patients in the first week [23].

Advancement

Development and Validation of PhytoDental Solutions Dental Anxiety Score (PDSDAS)

Previously we introduced development of the PDSDAS which relies on a combination of 8 questions score from 0-4 based on 3 previously validated assessments, 2 for anxiety (GAD-7 and HAM-A) and the Insomnia Severity Index (ISI) [24]. Subjects are asked to score two psychic (anxiety before and while waiting), five somatic (cardiovascular, respiratory, gastrointestinal and autonomic) characteristics and one inquiry into their quality of sleep prior to the dental office visit or procedure. This self-reported assessment spanned the time from the night before the dental visit (T0), to immediately afterwards in-office (T1), and lastly 24 hours post visit (T2). Scoring was from 0 to 4 with 0 denoting no anxiety and 4 denoting extreme anxiety.

Dual Dose AM/PM CBD full spectrum formulation protocol (DDFSP)

The PDSDAS was utilized to evaluate the effectiveness of a Dual Dose AM/PM CBD Full Spectrum Formulation Protocol (DDFSP) on Dental Anxiety in a Real-World Setting [25]. PDSDAS was shown to be validated simultaneously and in parallel to the DDFSP by statistical analysis of anxiety scoring across the protocol's three self-assessment times (T0, T1, T2). PDSDAS scoring by both t-test comparisons and ANOVA Analysis resulted in 1-tail statistical differences with p-values <0.05 for both approaches. DDFSP data indicated significantly reduced measures of psychic dental anxiety (43% to 67%) and somatic anxiety (51%) as measured over the three time points: (T0) from the night before the visit, (T1) immediately after, as well as (T2) 24 hours afterwards. The PM dose was formulated to assist with relaxation and sleep the night before. The AM dose was formulated to calm the patient the day of the procedure to be taken 15 minutes before arrival at the dentist's office. Both proprietary formulations were decarboxylated full spectrum hemp CBD oral micellular formulations (i.e. Hempzorb™) containing CBD, Cannabidivarin (CBDV) and Tetrahydrocannabivarin (THCV). Additionally, the quality of sleep the night before was found to be improved by 87% of test subjects.

Breaking the cycle of dental anxiety

Chronic anxiety-driven dental care avoidance leads to understandable poor dental health characterized by development of widespread caries, tooth loss and poor periodontal health leading to bone loss. Such patients appear at the dentist's office then under both the combination of dire oral and often physical health as well as with the anxiety-driven fear of the dental visit. We have recently developed a Dual-Dosing (AM/PM) Full Spectrum CBD (DDFSCBD) combination of two broad-spectrum hemp formulations as an anxiolytic treatment [25]. Our resulting interventional model to break what has been called the 'vicious cycle of fear' [26] illustrated here (Figure 1) and discussed later shows promising early results.

Oral health to systemic disease ecosystem

Additionally, we understand the importance of recognizing a patient's systemic disease co-morbidities (Figure 2) which have been pointed out act as a multiplier in dental disease states [27]. Identifying oral symptoms of underlying systemic disease has been reviewed and discussed previously emphasizing the need for dental professionals and family medical physicians to work together and recognize these complicating factors [28,29]. In brief, oral examination can reveal signs and symptoms of immunologic diseases, endocrinopathies, hematologic conditions, systemic infections, and nutritional disorders. In addition, several studies have reported associations between periodontal disease and diabetes mellitus, [30] coronary heart disease, stroke, [31] and adverse pregnancy outcomes [32]. The oral mucosa should be viewed similar to the blood brain barrier, though much more penetrable, for a breakdown in the oral mucosa as occurs with the development of gingival inflammation leading to caries offers direct access to seeding the individual's circulatory system with microbes giving access to all major organs. The most well understood of these are the links with infective endocarditis following dental procedures for patients with underlying cardiac conditions and in high-risk categories such as those with prosthetic joint replacements [33].

Our developing understanding of the role phytocannabinoids play in the Oral Health to Systemic Disease Ecosystem may be one principally of microbiome influencers. Cannabinoids regulate the oral microbiome in a fashion similar to systemic homeostatic activity favouring establishment of a "healthy" equilibrium of microbes. Anti-inflammatory effects assist in repair of the mucosal barrier before further damage leads to systemic entry of oral microbes (i.e., blood oral mucosal barrier (BOMB)). Anti-bacterial and anti-fungal activity with phytocannabinoid formulations result in the substantial decrease in opportunity of oral microbes transitioning to a pathogenic state, thereby also allowing for the healing process to take place. Phytocannabinoids do not eliminate all bacteria which can result in selective overgrowth of more pathogenic or resistant strains as with current antibiotics.

Anxiety in the workplace

Treating patients with dental anxiety is a workplace stressor felt not only by the dentist but by dental hygienist, the receptionist as well as other attending patients. Dentists are included in the National Institute for Occupational Safety & Health (NIOSH) list of jobs with highest suicide rates. Physician suicide remains the occupation with the highest suicide rates with dentists recognized as second. Multiple psychological disorders have been recognized to be factors affecting Dentists which may lead to a recognized increase in substance abuse in this profession [34]. Studies have found higher than 80% of dentists believe: they are much stressed daily; more than half believe their profession more stressful than others; with anxious dental patients the most intent stressor [35].

Summary

When an assay such as the PDSDAS is used as an instrument to understand a subject's anxiety state in their care, the practicing dentist and dental team are in a better position to ensure the experience has the best possible outcome. Understanding a patient's psychic component- the individual's built-in level of anxiety and their somatic component- the physical systemic manifestations are important to recognize thereby allowing the dental team to proceed appropriately to the subject's individual state of anxiety.

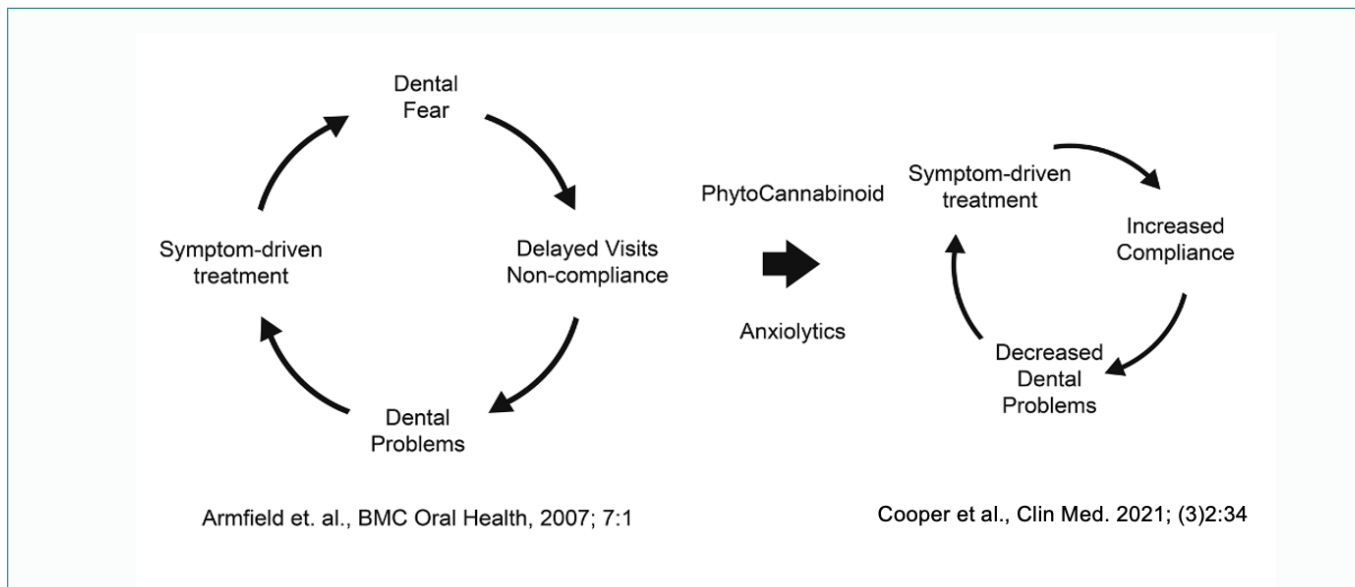The Dental Anxiety scales discussed here can be accomplished

Figure 1: Breaking the cycle of dental fear. Utilization of an appropriately timed anxiolytic in such a way as to moderate a subject's anxiety level ultimately leads to improved dental health outcomes. Lack of dealing with dental fear in an ongoing nature leads to chronic poor dental health with untoward consequences, i.e., dental caries to periodontal disease and bone loss.
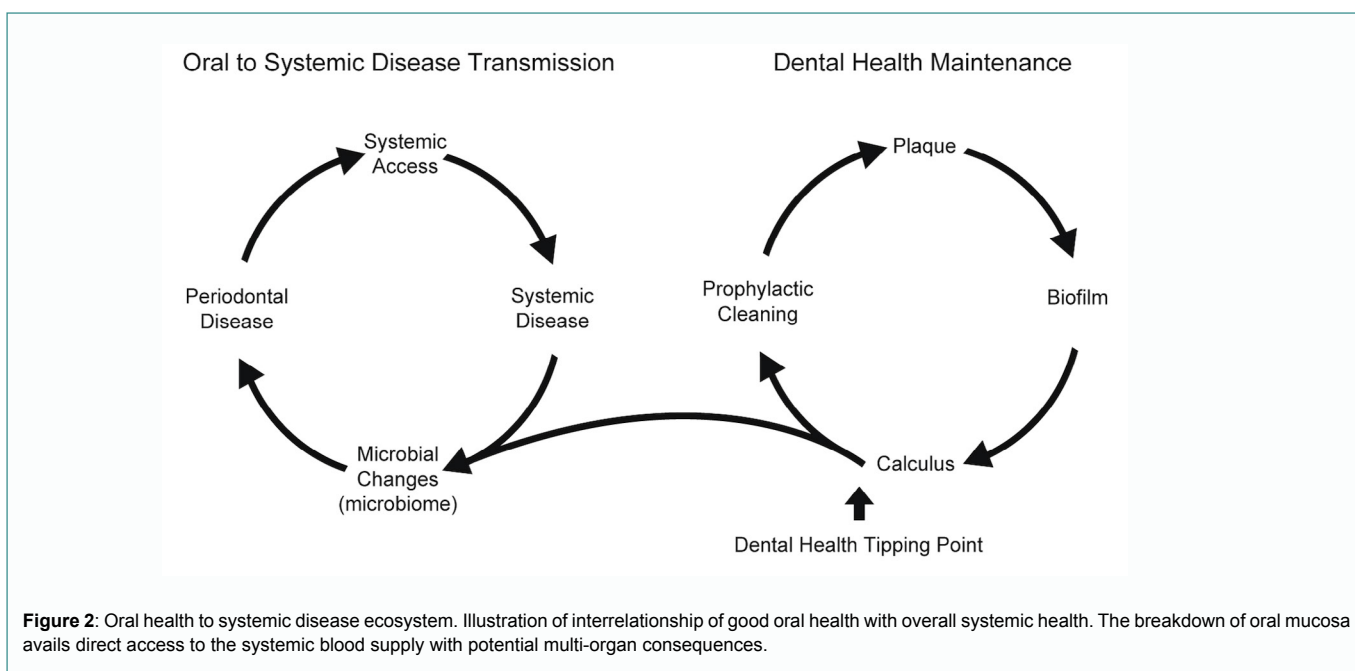

Figure 2: Oral health to systemic disease ecosystem. Illustration of interrelationship of good oral health with overall systemic health. The breakdown of oral mucosa avails direct access to the systemic blood supply with potential multi-organ consequences.

in the office waiting room with each visit taking less than 5 minutes. This self-assessment form can be recorded by scanning or tablet technologies, easily archived and retrieved and reviewed prior to a patient's visit. The record can then be used to understand the patient's historical level of anxiety and measure if procedures (i.e., cannabinoid or drug therapy, behavioural interventions) put in place to measure the effectiveness of ameliorating dental anxiety are working.

Early experience in our practice indicates the potential for utilization of anxiolytic approaches varies due to the different classes of patients. Although the occasional patient may require sedation for routine cleaning and regular maintenance (as does one member of the PhytoDental Solutions team), in general the more significant the procedure the more serious the anxiety is often accompanying (i.e., root canals to surgical procedures). The common experience of emergent patients entering the dental practice facility is one of the most (if not most) difficult for the dental team to handle effectively. A combination of staff training in psychotherapeutic interventions and sedative pharmacologic interventions offer some tools for this class of patient. However, more promise for the recurring patient to utilize in addition to current formulations, new therapeutic approaches targeting homoeostatic regulation pathways, such as the phytocannabinoids which act without significant adverse effects, will hold an increasingly important role.

Working with apprehensive and fearful patients is associated with

significant psychological stress for the dental practitioner and their staff as well [36]. An early study found half of dental schools that offered predoctoral students course work dealing with professional stress found only roughly that one in seven taught dental hygiene students anything in regards to how to deal with professional job-related stress [37]. The dental team (e.g., dentist, hygienist, receptionist), due to the constant exposure to patient dental anxiety, are prone to experience the same physiological stress responses as the patients themselves, i.e., increased heart rate, increased blood pressure, autonomic effects, etc. The incidence of early coronary events, with suicide and psychoneurotic disorders, is twice that of physicians [38]. Being cognizant of the subject's anxiety and proactively intervening to reduce the patient's dental anxiety will lower overall workplace stress levels. Making these actions routine in the practice of dentistry will ultimately reduce the morbidity and mortality rate of the stress-related disorders associated within the dental profession.

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