Applied behavioural analysis principles in dentistry: techniques to overcome dental fear, improving attendance and compliance

Dental fear is a global, socially important health concern, impacting quality of life, psychological well-being, and oral and general health. Avoidance behaviour influences patients’ attendance, with pain often the antecedent catalyst for accessing care. Applied behaviour analysis (ABA) studies the application of the principles, methods, and procedures of the science of behaviour as applied systematically to improve socially significant behaviour. Dental teams using behavioural assessment can assess dental fear, its aetiology and nature, to identify apprehensive patients. Dental fear should be acknowledged, discussed and evaluated. Effective communication increases patient satisfaction, co-operation and compliance, and reduces dental fear. Assess, advise, agree, assist, arrange. ABA strategies help patients to resolve dental fear through coping and increased self-efficacy, but require willing and motivated patients. Goals should be set, with patients’ self-identified barriers removed.

Behaviour modification therapies aim to change undesirable behaviours through learning, behavioural and cognitive strategies. Cognitive behavioural therapy (CBT) techniques focus on thought and behavioural patterns to help patients identify unproductive or self-defeating thoughts, and is currently the most accepted and successful psychological treatment for anxiety and fear. Patients should be aided during treatment via coping to restructure perceptions of dental treatment with perceived control and predictability. Anxiety can affect memory, resulting in catastrophising and remembering increased pain after treatment. Dental fear can be managed with behavioural and/or pharmacological intervention. It is worthwhile to convince patients via role induction to participate actively in treatment as this decreases pain perception, improves mood and focuses attention away from pain. Dentists benefit more from non-pharmacological approaches, resulting in highly satisfied patients and strong practices.

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Georgina Staunton BA(Hons) Psychology
Registered Dental Hygienist

Dr John Hyland CPsychol
Lecturer in Psychology
School of Arts
Dublin Business School, 13-14 Aungier Street, Dublin 2
Visiting Research Fellow, School of Nursing & Midwifery
Trinity College Dublin

Corresponding author: Georgina Staunton georginastaunton@hotmail.com
**Introduction**

The purpose of this article is to outline the uses and importance of applied behaviour analysis (ABA) in dentistry. ABA studies the tactics derived from principles, methods, and procedures of the science of behaviour when applied systematically to improve “socially important behaviours that have immediate and long lasting meaning” for both patients and dental treatment providers. ABA has been used in a dental setting to reduce phobia and dental care-related fear and anxiety. This article outlines strategies to reduce dental fear that are consistent with ABA principles. In this article, phobia, fear and anxiety in relation to dental care will be termed “dental fear”. This article will outline the aetiology of dental fear, the benefits of behavioural assessment, and possible intervention strategies useful for the dental team in helping patients to cope. The target behaviour for patients is to engage with dental treatments and reduce and/or eliminate the fear associated with dental treatment.

**Aetiology of dental fear**

The development of dental fear is multifaceted. Beaton, Freeman and Humphris outlined research evidence for mechanisms of acquiring dental fear as direct learning due to a traumatic dental experience (classical and operant behaviour—see below), vicarious experience or conditioning through others’ experiences, verbal threat via the media and others, or inherited and personality traits. Carter et al. also included cognitive content and cognitive biases as causes for dental fear, while acknowledging the need for research.

**Conditioning**

Dental fear may be classically conditioned by a previously neutral stimulus directly eliciting responses through pairing this with another unconditional stimulus that elicits the same response. For example, an individual who experiences a painful procedure (and the unconditional response of anxiety/fear) during a dental visit may acquire a conditioned association between the dentist (the conditioned stimulus) and anxiety/fear (the conditioned response). Re-presentation of the conditioned stimulus (the dentist or related stimuli) can elicit the conditioned response of anxiety during the patient’s next dental visit. When aversive stimuli are avoided, fear is reduced and avoidance behaviour is maintained; this is known as negative reinforcement.

Operant conditioning is the procedure of presenting a reinforcing stimulus immediately following the occurrence of a given response. Conditioning is said to occur if and only if the response then increases in rate of occurrence, magnitude, or relative frequency, or decreases in latency as a consequence of the operation.

Operant behaviour is selected, shaped and maintained by consequences from past behaviours. Reinforcement is stimulus change after a response increases the likelihood of a behaviour repeating in similar circumstances.

**Stimuli**

Stimuli and responses to them represent continuous, ever-changing interaction between an organism and its environment. Fear-inducing stimuli in dental care settings include lying back in the “chair, pain, anticipation or memory of pain, sight and sound of hand-pieces, and receiving local anaesthetics injections and environmental factors of lack of predictability and control, inability to escape or leave the dental setting.”

**Fear**

Fear is a robust, distressing emotional response characterised by immediate physiological response, apprehension, dismay, escape and avoidance that may culminate in a ‘panic attack’. Anxiety is a cognitive, negative and emotional response associated with thoughts and worries, for example regarding dental treatment. Avoidance postpones or prevents stimuli; escape terminates ongoing stimuli.

Dental phobia, known as odontophobia, is a situation-specific, dental care-related phobia. Dental fear is a global, socially important health concern impacting oral and general health, psychological well-being and quality of life for patients, which increases avoidance behaviour. Symptom-driven treatment exacerbates dental fear and anxiety, and perpetuates a vicious cycle of dental fear (Figure 1). Dental fear is a distinct emotional state that influences how and when patients will access dental treatment. Pain is often the catalyst for accessing treatment.

**Dental fear**

The dental surgery is a unique environment. Dentists are experts in oral healthcare. Patients are experts in their own lives, values, wishes, fears, and goals.

The catalyst for seeking treatment is the stimulus of pain, the behaviour is attending for dental treatment, and the consequence is dental treatment for the relief of pain. This amounts to punishment by removal of a stimulus, or negative punishment in behavioural terms, which can lead to the preceding behaviour being reduced. Response cost is when the future frequency of attending for dental treatment is reduced. This can be mediated by combining response cost with positive reinforcement and reducing the likelihood of the dental team becoming a conditioned aversive stimulus and perpetuating avoidance.
Stimuli within the dental environment can be determinants of dental pain, and patients do not see these enough to become accustomed to them, so the stimuli retain their novelty.7 Reinforcing the respondent behaviour of attending for treatment by the dental team may give patients the opportunity for concept formation or cognitive restructuring to reduce avoidance and acquire control over their dental attendance and treatment.7,8 If a dental fear-inducing stimulus is presented repeatedly, the magnitude and strength of the fear response may diminish via habituation,7,8 which can occur if patients return for treatment. Convincing patients in pain, with dental fear, to return for treatment should be a priority for dental teams.8

**Types of dental fear**

Mowrer’s two-factor theory11 says that fear-inducing stimuli in the dental care setting act as conditioned stimuli, as they are present before the unconditioned stimulus that is painful, which results in the patient having a fearful reaction or unconditioned response. Neutral stimuli, paired with the painful stimulus, result in the fear response. Previous neutral stimuli (dental sights, sounds, smells) may elicit dental fear without any painful stimulus present. Dental fear is the conditioned response. When patients avoid the dental office, fear is reduced and avoidance behaviour is maintained.7 Davey12 proposed that painful dental events do not always evoke future fear. A conditioned response is more difficult to establish if many positive experiences happen between a conditioned stimulus and an unconditioned stimulus. Patients who regularly attend the dentist and have positive experiences may take longer to associate the conditioned and unconditioned stimuli to produce a conditioned response. Associations can be made between unconditioned stimulus and conditioned response following painless treatments.7

Lethem13 proposed that patients who avoid the dentist out of fear either cope with pain, or have a catastrophe response. Catastrophising leads to a cycle of avoidance and potential disability. Patients’ evaluation of and response to pain is important. Patients may feel their heart rate increase during dental treatment because of physiological arousal, and believe that they could have a heart attack, thereby catastrophising dental treatment and initiating fear.7 Catastrophising focuses on negative outcomes to predict pain. Catastrophising dental patients may worry excessively before treatment, which causes stress.8

Reiss and McNally’s14 expectancy model states that some patients expect the dental situation to elicit heart palpitations, embarrassment with reduced emotional control, or to be dangerous or threatening, which increases escape or avoidance behaviours. Avoidance is maintained through negative reinforcement; fear is reduced when avoiding the dentist and reducing fear increases avoidance. Patients with high levels of dental fear expect and experience more pain than patients with low dental fear. Patients remembered suffering more pain three months post treatment than immediately afterwards. This altered memory functions to reinforce avoidance.7

Hayes, Strosahl and Wilson15 outlined acceptance and commitment therapy (ACT), which looks at how patients interact with their environment. Accepting things as they are and without judgement, rather than ideally, ACT may reduce reported pain and enhance emotional, social and physical functioning, as well as increasing patients’ utilisation of services. Patients’ increased awareness of physiological responses, without judgement or struggle, may increase coping and make patients more tolerant of dental procedures.7

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**Table 1: Strategies for managing patients with dental fear.**

<table>
<thead>
<tr>
<th>Strategy type</th>
<th>Strategy</th>
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</thead>
<tbody>
<tr>
<td>Non-relaxation</td>
<td>Communication: listen, ask, assess, acknowledge and address</td>
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<tr>
<td></td>
<td>Shaping: praise for attending, for complying and completing treatment</td>
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<td></td>
<td>Distraction: breath control, legs up, physical or mental distraction</td>
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<td></td>
<td>Stop signalling: the patient raises a hand if they need a break (increases control)</td>
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<td></td>
<td>Tell-show-do: increases predictability</td>
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<td></td>
<td>Modelling: seeing a sibling complying with treatment in children</td>
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<td></td>
<td>Flooding/implosion: repeatedly exposing patients to the conditioned stimulus until the conditioned response is terminated</td>
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<tr>
<td>Quasi-relaxation</td>
<td>Guided imagery</td>
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<td></td>
<td>Biofeedback</td>
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<td></td>
<td>Acupuncture</td>
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<td>Relaxation</td>
<td>Formal progressive muscle relaxation</td>
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<td>Computer-assisted relaxation learning</td>
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<td></td>
<td>Modified systematic desensitisation</td>
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<tr>
<td></td>
<td>Hypnosis: used for somatic and cognitive anxiety</td>
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<td></td>
<td>Cognitive behavioural therapy – psychotherapeutic</td>
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<tr>
<td>Pharmacological</td>
<td>Inhalation sedation: nitrous oxide</td>
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<td>Oral sedation: benzodiazepine</td>
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<td>IV sedation</td>
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<td></td>
<td>General anaesthetic</td>
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**Behavioural assessment**

Behavioural assessment,7 as part of a dental examination, will enable the planning, implementation and evaluation of intervention strategies aimed at reducing dental fear during treatment and habilitation. Habilitation is the change in patients’ repertoire to maximise reinforcement and minimise punishment.7 Habilitation can include cognitive, social, fine motor, gross motor, or other skills that contribute to mobility, communication, and performance of activities of daily living and enhance quality of life. For example, equipping patients (e.g., children) with skills for good oral health will help them to obtain reinforcement about how well their teeth look, and increase the likelihood that they will be praised, for example by their dentist, when they go for future check-ups.

**Fear assessment**

Dental care professionals using behavioural assessment with effective listening16 can assess dental fear in a comprehensive manner to identify its aetiology, nature and associated components,17 and understand the patient’s experience, thereby reducing anxiety and aversive states.48 Apprehensive patients should be identified and their worries discussed. Dental fear should be acknowledged, discussed and evaluated. Patients with dental fear often see dental treatment as “potentially dangerous, uncontrollable, unpredictable and disgusting”.16 Evaluation though interviewing, self-reporting on fear and
anxiety scales, as well as objective assessment of blood pressure, pulse rate, pulse oximetry, finger temperature, and galvanic skin response, can aid the categorisation of dental fear. When a patient presents for treatment, they should be positively reinforced for seeking help, not criticised for their current oral health status. Reassurance, though well intentioned, can dismiss patient worries or complaints. Instead, communication that reflects attention, politeness, empathy and respect can facilitate dental care. Effective communication can increase patient satisfaction, co-operation and compliance, and reduce patients’ dental fear.

Stress response and coping
Primary appraisal is the assessment of events in the environment and secondary appraisal is a person’s assessment of their own ability to cope with those events. Acknowledging that the stress response activates secondary appraisal, allowing patients an outlet for the expression of stress, protective factors can be initiated, coping mechanisms instigated and stress reduced. The dental team can positively frame the treatment process and instigate coping. Coping can be emotion focused, problem focused or passive. Individuals’ coping styles will affect how they respond.

Emotion-focused coping may reduce negative emotions such as dental fear when stress is uncontrollable, such as during treatment, but may delay dealing with problems. This can be particularly relevant for the personality type known as ‘blunters’. Blunters (who require very little expansion of explanations) prefer less information during treatment. Problem-focused coping targets the causes of stress practically, dealing with the stressors and thereby reducing stress via problem solving. Problem-focused coping has limited use in uncontrollable situations such as dental treatment, but is useful for oral health preventive behaviour. Those who fall into the ‘monitors’ personality type are relevant here. They are information seekers who like detailed descriptions of treatment, are more informed and have high expectations. Lack of control can be a stressor, control can buffer stress, and those with an internal locus of control cope better.

ABA in the dental setting
Dental treatment to remove the stimulus pain can be construed as negative punishment. This reduces the likelihood of dental attendance in future as punishment decreases the future frequency of behaviour. Behaviour replacement strategies should be implemented for positive reinforcement of the stimuli that are contingent on behaviour. ABA strategies allow patients to reduce and unlearn their fears, and to resolve dental fears through coping to facilitate dental care. These strategies increase patients’ self-efficacy and increase attendance and acceptance of dental care plans, but require patients who are willing and motivated to participate. Goals should be set with patients, with patients’ self-identified barriers to treatment removed. Practitioners should assess, advise, agree, assist, and arrange. Careful choice of language should be used to describe sensations in a non-threatening manner.

Behaviour
Appukuttan, Botto et al., Carter et al., and McNeil et al. provide information on many strategies with operant conditioning for managing patients with dental fear. Behaviour modification therapies aim to change undesired behaviours through learning behavioural and cognitive strategies (Table 1).

Cognitive
Cognitive strategies aim to alter and restructure the content of negative cognitions to enhance control over negative thoughts. Cognitive behavioural therapy (CBT) is a combination of behaviour therapy and cognitive therapy, which uses techniques focused on thought and behavioral patterns to help patients identify unproductive or self-defeating thoughts. CBT is currently the most accepted and successful psychological treatment for anxiety and fear. Concept formation can restructure a patient’s thoughts regarding sensations experienced during treatment and is a complex example of stimulus control. Cognitive processing relates to the dental experience and the expression of pain, and patients should be aided during treatment to use coping strategies with a positive, proactive approach to pain management. Catastrophising and memories of increased pain are common aspects of treatment after the event. Cognition establishes, maintains and alters memories of dental pain and perception of the dental treatment experience, and is important, as anxiety and fear affect memory and are joined in a single construct within memories over time. Dentistry can be perceived as uncomfortable, intimidating or repulsive. Controllability is the patients’ ability to control the beginning, end, duration and intensity of the dental treatment experience. Actual control is when a response changes the experience, such as the patient raising a hand to take a break. Perceived control refers to the belief of the patient that they are in control. Giving control to patients or increasing perceived control can increase pain tolerance. Predictability during treatment, or the use of tell-show-do, can aid patients in coping. Tell-show-do is a systematic explanation to patients of what you will do, following by showing them what you will do, how you will do it and what you will use, then doing the proposed treatment, thus increasing predictability and aiding coping.

Pharmacological options
Dental fear can be managed with behavioural interventions, pharmacological interventions, or a combination of both, depending on the level of dental fear, patient characteristics, and clinical situations. Interventions are either behaviourally or cognitively oriented. Pharmacological management can be achieved with sedation or general anaesthesia. If a patient is not able to respond to and co-operate well with behavioural interventions, is not willing to undergo these types of treatment, or has extreme fear, then pharmacological treatment should be sought.

Conclusion
In conclusion, dental fear is a problem for many dental patients. Patients want to be involved in their care. There are many ways dental fear can manifest within patients. Dentists have a responsibility to reduce dental fear. When an anxious patient presents in pain for treatment, dentists have an opportunity to initiate a behaviour change, increase patients’ repertoire by allowing them to engage with treatment and to cope with intervention via reinforcement of alternate behaviours. This will facilitate future dental treatment and better oral health. Better understanding of dental fear from dental practitioners, with use of applied behavioural modification, may prevent future dental avoidance. A calm manner, giving reassurance, listening to patients, and informing them while encouraging active participation influence patient satisfaction. Patients have been conditioned to take a passive role and to comply. Role induction can convince patients to participate actively in their treatment, as this decreases pain perception, improves mood and focuses attention away from pain.
induction is regarding the roles of patients and providers as listeners and speakers, as many patients have been conditioned not to speak but to be silent passive receivers of care as determined by the team. As a last resort, patients can be managed using sedation or general anaesthesia if they are unable to use psychotherapeutic interventions, are not willing to undergo these types of treatments, or are too dental phobic. Dentists benefit as passive receivers of care as determined by the team.


