Vibration for counter-stimulation and pain reduction

Background

- The Broxo Plus (www.broxo.com) is a mains-powered motorised toothbrush which oscillates at 50 Hertz (50 cycles per second) which is simply the frequency of AC current. It provides a source of intense vibration which is almost universally interpreted by people as being pleasant. It is easily placed in a hand or the mouth, and is safe in a wet environment. As well, the heads are autoclavable and don't break when suddenly bitten on as they might be with cerebral palsy children, or people with brain injury. More importantly, biting on the brush head does not stop the vibration or wreck the motor unit. If a brush head is used, it must only be used on one particular patient. It MUST not be used for any other patient.

- The "Gate-control" theory of Melzack and Wall (1965) states that stimulation of larger diameter fibres (e.g. using appropriate pressure or vibration) can close the neural "gate" so that the central perception of itch and pain is reduced. They note (p976) that, "The stimulation of a single tooth results in the eventual activation of no less than five distinct brain-stem pathways." Two of these pathways go on to consciousness in the sensory cortex, and the other three go on to the thalamic reticular formation and limbic system - in other words to the emotional control centre of the brain.

- Since more than a third of the cells in the cerebral cortex are devoted to sensory inputs from the mouth (Barr 1979), it follows that dentists, therapists and hygienists work in one of the most sensitive areas of the body. This helps to explain why it may only take one traumatic experience to produce an on-going anxiety or even phobia about dental care. Since a third of the cells in the sensory cortex are devoted to the hand, especially the palm and thumb, it also helps to explain the effectiveness of holding a source of vibration in the hand as a counter-stimulation when touching the mouth and teeth. (Figure 1. below)

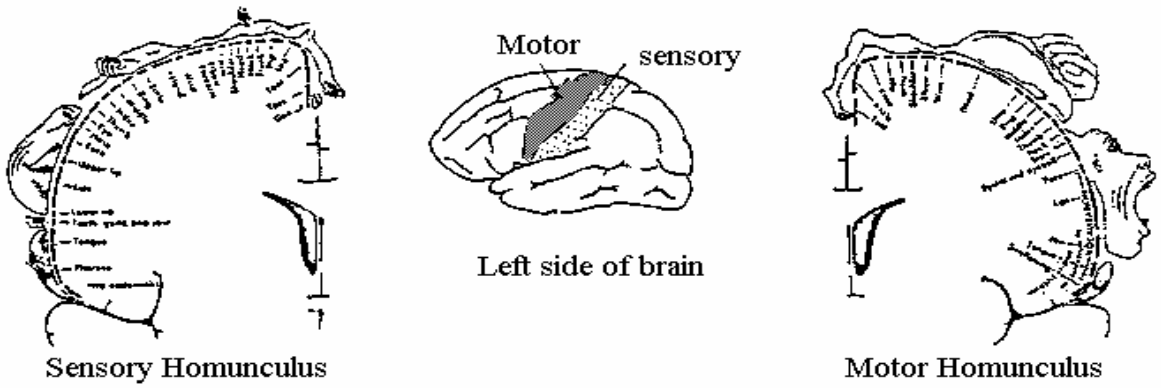


Figure 1. Sensory and Motor homunculi on the left side of the brain

- Vibration has been used to reduce the perception of itch (Melzack and Shecter, 1965); to raise the pain threshold (Ekblom et. al. 1982; Pantaleo et. al. 1986; Sherer et. al. 1986); for successful relief of acute or chronic pain using vibration with moderate pressure for about 20-30 minutes with frequencies between 50 and 200 cycles per second (Lundeberg et. al. 1984, 1988); for relief of pain of dental origin whether pulpal, periodontal, or post-

surgical (Ottoson 1981); and for the relief of chronic intractable oro-facial pain (Lundeberg et al 1983).

- Recent research (Guieu et al 1994) has shown that the analgesic effects observed during the application of vibration and the pain relief which sometimes persists for several hours afterwards is not related to the release of endogenous opioids.

- Pain reduction is greatest if the source of vibration is applied within the area directly affected by pain, and when the firmness of application stimulates the underlying bone on the same side as the pain. No effect is felt if the stimulation is to the contralateral side (Lundeberg et al 1983).

- The pain-alleviating effect observed is not a result of placebo effects. Thus pain reduction is only observed when the stimulation was applied in the affected region (Lundeberg et al 1983).

Using vibration when giving LA

- During use the Broxodent should be plugged in to a power supply with body-protection circuitry. The transformer in the plug reduces the voltage to 14 volts AC from the normal 220 volts. For cross-infection purposes, the motor unit can be wiped down with neutral detergent and isopropyl alcohol between patients or put in a plastic sleeve which is changed after each patient. The brush-head should be wrapped in a plastic sleeve to prevent contact with the saliva and then re-autoclaved after use.

- Topical anaesthetic, warmed solution, slow injection technique are assumed as givens.

- All the time the patient is also holding the brush with one hand as this provides a source of "counter-stimulation" in that hand as well as in the mouth.

- There are two basic ways that vibration is applied to the mouth:-

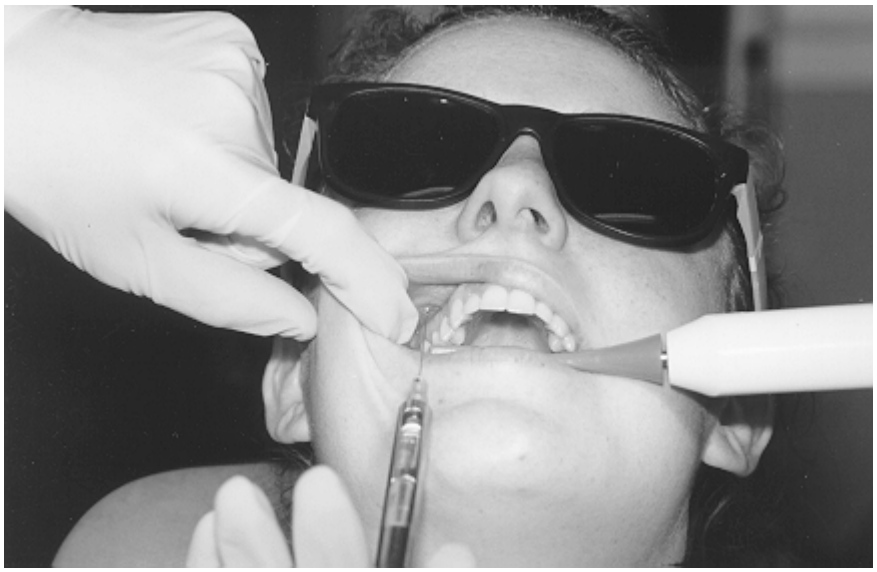
    1. The patient places the end of the motor unit against the chin and the teeth together in occlusion for maxillary and mandibular infiltrations. It works even better for anterior infiltrations if the anterior teeth are placed edge to edge so that the periodontal ligament and bone tooth in the injection site are more stimulated. Alternatively, the unit can held against the bone of the cheek on the same side as the infiltration of the maxilla.

    2. The patient pushes a vibrating Broxodent motor unit firmly against the lower border of mandible for an inferior dental blocks (IDB) on the same side as the injection. The vibration should be felt by the operator when palpating the retro-molar fossa prior to injection.

- There are two other ways to do this: if the patient has been given his or her own brush head (this is not shared between patients)

3. If patient has his or her own brush head, this can be bitten on and angled coming across from the other side of the mouth so that the operator's vision is not blocked. The hand holding the brush also gets counter-stimulation from holding the motor unit. (buccal, interdental, and intra-ligamentary injections).

   NOTE: Especially with Special Needs patients a mirror may be preferable to a finger for retracting the lip or cheek.



Biting on the brush-head coming in from the other side of the mouth for an infiltration on the right side.

4. If patient has his or her own brush head, the brush-tip can be pressed into the palatal mucosa immediately adjacent to where needle is inserted (Palatal injections). This is the least effective way to use the Broxodent. Usually it is more effective to achieve palatal anaesthesia by infiltrating through the interdental papilla from the labial or buccal.

5. Alternatively, the unit can held against the bone of the cheek on the same side as the infiltration of the palatal mucosa and a ball burnisher used to blanch the tissue at the site where the injection is to be placed. The vibration of the maxilla, and the local pressure makes a very significant difference to the discomfort of this injection.

Ultra-slow Technique

Background

- In deciduous molars, the nerve supply to the occlusal dentine is less dense than the nerve supply to the approximal or cervical dentine (Egan CA et al 1999). This means that careful excavation of even quite deep occlusal caries is often not uncomfortable for a small child for instance who may be frightened of local anaesthetic. On the other hand it is virtually impossible to excavate interproximal caries adequately without the use of local anaesthetic.

- Excavation of root caries may often be done with minimal or no discomfort except where it goes subgingivally where peri-press LA may be needed for the gingivae and matrix band (e.g. Automatrix). Interproximal root caries is often more sensitive and usually needs LA

- An ultraslow handpiece is a mechanised way of lightly excavating caries with no or minimum discomfort. It is much easier on wrists and hands than the persistent use of hand instruments. Less pressure on the tooth is required so hydraulic changes in the pulp due to pressure from hand instruments is avoided and hence the procedure is more comfortable.

- The use of ultra-slow handpiece is just one of the range of options for excavating caries. Experience has shown that it can reduce the number of people referred for general anaesthetics.

The Ultra-Slow kit

This consists of:-

- An ultra-slow handpiece with a 10:1 reducing shank and a 10:1 reducing head. This rotates as slow as one revolution per second or 60 - 200 revs per minute. This allows excavation of occlusal caries using a new steel or tungsten carbide (TC) bur. It is usually perceived of as non-threatening and may be preferred to faster "low-speed" handpieces. Set the Kavo 181M Airmotors to their fastest setting in the speed range for Ultra-slow use. This gives about the right speed and enormous torque. Even at slow speeds a sharp tungsten carbide bur will steadyly grind through enamel and dentine.

- A Broxodent electric toothbrush motor-unit is placed in the patient's hand and switched on as a counter-stimulation. The patient continues to hold the switched on electric toothbrush throughout the time when the restoration is being done. The Broxodent should be plugged in to a power supply with body-protection circuitry. The transformer in the plug reduces the voltage to 14 volts AC from the normal 220 volts The motor unit can be wiped down with neutral detergent and isopropyl alcohol between patients or put in a plastic sleeve for cross-infection purposes.