Vibratory Stimulation as a Method of Reducing Pain after Orthodontic Appliance Adjustment

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Pain is an all-too-common experience of patients undergoing any form of dental treatment, to the extent that 77% of a patient population reported some degree of pain from a visit to the dentist.\textsuperscript{1} Pain following orthodontic adjustments appears to be equally prevalent.\textsuperscript{2-10} Jones and Chan showed that compliance with orthodontic treatment may be predicated on the amount of initial pain and discomfort experienced.\textsuperscript{5} Other studies indicate that plaque control may suffer as a result of the pain associated with orthodontics.\textsuperscript{7,11}

Although analgesics have been found to reduce such discomfort, in most cases they do not totally eliminate it.\textsuperscript{12-15} Moreover, some patients may be allergic to these agents, and one report suggested that nonsteroidal anti-inflammatory drugs may adversely affect the rate of tooth movement.\textsuperscript{14}

Patients who do not respond to or elect not to use pharmacological therapy have had few practical alternatives. Some orthodontists recommend chewing on gum or a plastic wafer immediately after adjustments.\textsuperscript{16} Proffit suggested that lower force levels could reduce pain,\textsuperscript{17} but Lim and colleagues showed that pain or discomfort was still experienced by most patients even when “physiologic and light forces” were used.\textsuperscript{18}

Recently, there have been major developments in the understanding of pain mechanisms and of new approaches to the management of pain.\textsuperscript{19} Low-level laser therapy has been shown to produce analgesic effects in many clinical applications, including orthodontics.\textsuperscript{18} Transcutaneous electrical nerve stimulation (TENS) is another non-pharmacological, non-invasive method of reducing post-orthodontic adjustment pain.\textsuperscript{20,21} Vibratory stimulation, a classic non-invasive and non-medicinal method of reducing pain, could also be effective in orthodontic patients.\textsuperscript{21-26}

The orthodontic application of this method was first investigated by Dr. Powers on a patient with a history of painful post-adjustment episodes during closure of a wide maxillary midline diastema with elastic chain. After placing a new elastic chain, Dr. Powers observed that gentle vibration of the maxillary central incisors produced two effects: the blanching of the tissue between and above the incisors was quickly reversed, and the previous level of pain did not occur.

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This encouraging observation was the impetus for the commercial fabrication of a patient-controlled appliance that could translate a vibratory effect to all the teeth.* A small, battery-operated vibrating motor with two amplitude settings was coupled to a flexible, detachable, soft acrylic mouthpiece for this purpose (Fig. 1).

Random testing by other orthodontists indicated that gentle vibration of the teeth eliminated or significantly reduced post-adjustment orthodontic pain. It was observed, however, that the appliance had to be used before the pain was evident, because once the pain was manifest, the vibratory effect did little to ameliorate it. This corroborates the theory that the cause of orthodontic pain is a diminished blood supply to the teeth and surrounding tissues. Vibration appears to reestablish the blood supply and intercept the ischemic response. Once the pain-inducing ischemic response is established, however, the analgesic response to vibration is minimal.

The following study was designed to investigate the effectiveness of vibratory stimulation as a means of managing orthodontic pain associated with periodic appliance adjustment.

Materials and Methods

The study population consisted of 21 male and 27 female adult and adolescent patients presenting for comprehensive orthodontic treatment at Louisiana State University. Patients who reported any dental pain prior to bracket placement were not included in the study. Anterior and posterior teeth were banded or bonded with conventional orthodontic attachments, and an initial .016" nickel titanium archwire** was placed in each patient.

Participants were told to refrain from taking pharmacological analgesics during the course of the study. The patients were randomly divided into two groups: Group A (mean age = 25.3 years) did not receive any form of pain relief, while Group B (mean age = 25.2 years) received only vibratory stimulation. Patients in the experimental group were asked to use the vibratory device for 15 minutes immediately after archwire placement. This involved gently biting on the soft plastic wafer, which was vibrated by the battery-powered motor (Fig. 2).

Both groups were given instructions to complete a visual analog scale modeled after Ngan. Each patient was asked to place an “X” on the line corresponding to the level of discomfort perceived at two-hour, six-hour, 24-hour, two-day, and three-day intervals following arch-

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Fig. 1 Vibratory stimulation apparatus.

Fig. 2 Patient using vibratory apparatus after archwire placement.
wire placement, after performing each of four simple exercises: chewing, biting, fitting the back teeth together, and fitting the front teeth together.

Results

The two groups were compared using repeated-measures analysis of variance and Student’s t-test. There were no significant differences between the two groups according to age or sex. However, there were significant differences between the overall pain scores of the two groups (p < .001) and among the various time intervals (p < .02). Significant differences (p < .02) were also found between the groups at each time interval (Fig. 3).

Discussion

Visual analog scales are an accepted method of measuring pain intensity in a clinical research setting where a quick numerical index is required. These scales have proven sensitive to both pharmacological and non-pharmacological methods of alleviating pain. They are less reliable in measuring absolute discomfort at any particular moment than in measuring changes in pain over time, as was done in the present investigation.

The reliability of patients in recording discomfort precisely and at the requested times could not be verified. Nevertheless, this study confirms previous findings that the intensity of orthodontic pain is greatest 24 hours following archwire placement. The results also indicate that discomfort was significantly less at every time interval for those who used the vibratory apparatus.

Most patients reported not being able to tolerate the vibratory stimulation after discomfort was present. This confirms the earlier observations that the vibratory effect must be induced prior to the onset of pain. If used in this manner, the device may be a useful tool in preventing the dental pain commonly associated with orthodontic treatment.

REFERENCES