



EBD spotlight: The adverse effects of orthodontic forces on the dental pulp



Manas Dave¹ reflects on topics in our sister

journal *Evidence-Based Dentistry*.

A *dverse effects of orthodontic forces on dental pulp. Appearance and character. A systematic review* was published in *Acta Odontologica Scandinavica* in 2023.¹ A commentary on this article was published in *Evidence-Based Dentistry* in March.²

Background

Orthodontic forces have been acknowledged for their ability to elicit intricate molecular transformations within the dental pulp. These alterations encompass a complex interplay of microcirculatory changes, dynamic fluctuations in growth factor expression implicated in angiogenesis, and heightened levels of inflammatory mediators.^{3,4} The emerging body of evidence suggests that

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'The emerging body of evidence suggests that prolonged and excessive application of orthodontic forces may even jeopardise the vitality of the pulp, thus implicating a compelling dose-dependent correlation between the magnitude of force and the molecular perturbations that underlie pulpal injury.'

prolonged and excessive application of orthodontic forces may even jeopardise the vitality of the pulp, thus implicating a compelling dose-dependent correlation between the magnitude of force and the molecular perturbations that underlie pulpal injury.³ Nevertheless, the existing literature presents conflicting viewpoints, necessitating a comprehensive assessment to unravel the multifaceted adverse effects of orthodontic forces on the delicate domain of the dental pulp.⁴

Hence, the aim of this systematic review was to provide an updated synthesis of data pertaining to the diverse effects of orthodontic treatment on the dental pulp.¹

Methods

An electronic database search of PubMed, Embase and Scopus was conducted from 2009–2022. Only studies where orthodontic force was applied with a control group (baseline values or contralateral teeth with no orthodontic treatment) and observed changes inside the pulp were included. Studies reporting root resorption, changes in tissues other than the pulp (eg periodontal tissues), traumatised teeth or where force was applied to other structures than teeth (eg sutures) were excluded. Studies were also excluded for poor quality, as determined using the Swedish Council of Technology Assessment in Health Care tool that was used for quality assessment.

Results:

- Twenty publications were included in this systematic review
- Quality assessment categorised studies into Grade A (high quality, n = 1) and Grade B (moderate quality, n = 19)
- Changes in pulpal blood flow: In ten studies, there was a significant reduction in mean pulpal blood flow with orthodontic treatment. This was observed in the first few days or weeks after applying orthodontic force. They reported recovery towards baseline pulpal blood flow
- Changes in tooth sensibility: In three studies, an increase in electric pulp tester (EPT) readings or an increase in the number of negative responses to EPT was observed with orthodontic force. Cold testing was done in one study which showed an increase in the number of negative responses. There were no signs of permanent damage
- Changes in inflammatory and hypoxia proteins: five studies reported aspartate aminotransferase (AST), neuropeptides and vascular endothelial growth factors. Whilst an increase in AST activity was noted after seven days, prolonged treatment (six months) did not exhibit significant changes. Additionally, an increase in Substance P, calcitonin gene-related peptide (CGRP), and vascular endothelial growth factor (VEGF) was observed
- Histological and morphological changes:

two studies reported vacuolisation and disruption of the odontoblastic layer, vascular changes (blood vessel dilation and congestion) and occasional pulpal nodules in orthodontically extracted teeth.

Conclusions

The authors concluded:

'...orthodontic forces appear to cause multiple detectable changes in the dental pulp... For the most part, these changes appear to be only temporary and to present during the first few days or weeks after applying orthodontic force.'

Commentary

This systematic review conformed to PRISMA guidelines incorporating clearly defined inclusion and exclusion criteria however there are certain limitations. The assessment of study quality was limited and searches confined to three databases with no additional hand or grey literature searching. There was no reasoning provided regarding the omission of quantitative analysis. Furthermore, it was unclear if a risk of bias assessment was conducted. The authors did acknowledge some of the limitations of the included studies such as the lack of long-term follow-up to determine long term changes, if any, to the dental pulp as a result of orthodontic forces. There is a need for higher quality research to provide sufficient evidence to answer the key questions relating to effects of orthodontic forces and the dental pulp.

References

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