

Effect of metal ions released from orthodontic mini-implants on osteoclastogenesis

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Dental and Medical Problems, ISSN 1644-387X (print), ISSN 2300-9020 (online)

Dent Med Probl. 2021;58(3):327–333

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Funding sources

The study was supported by the Research Institute of Rangsit University, Thailand.

Conflict of interest

None declared

Acknowledgements

The authors thank the Oral Biology Research Center, Faculty of Dentistry of Chulalongkorn University in Bangkok, Thailand, for facility support.

Received on April 14, 2020

Reviewed on February 14, 2021

Accepted on March 3, 2021

Published online on August 27, 2021

Cite as

Charoenpong H, Ritprajak P. Effect of metal ions released from orthodontic mini-implants on osteoclastogenesis. *Dent Med Probl.* 2021;58(3):327–333. doi:10.17219/dmp/133891

DOI

10.17219/dmp/133891

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Abstract

Background. Orthodontic mini-implants can undergo corrosion and the release of metal ions can affect cellular behavior. Osteoclasts are involved in orthodontic tooth movement and implant stability. Osteoclasts and their precursors can be exposed to metal ions released from orthodontic mini-implants.

Objectives. This study aimed to investigate the effect of metal ions released from orthodontic mini-implants on human osteoclastogenesis.

Material and methods. Stainless steel and titanium alloy mini-implants were separately immersed in culture media for 14 days (days 1–14), and then moved to new media for a further 14 days (days 15–28). The concentration of the released metal ions was measured. Osteoclast precursors derived from human CD14⁺ monocytes were cultured in these media and in a control medium without mini-implant immersion. Cell viability, the number of osteoclasts and the area of resorption were investigated.

Results. A higher concentration of metal ions was detected during the first 14 days as compared to the control. The concentration of these metal ions then declined after this period. The viability of osteoclast precursors was not affected by the released metal ions. There was a significant reduction in the number of osteoclasts when cultured in the medium with the titanium alloy mini-implants immersed for days 1–14. The area of resorption was also significantly reduced in this group. The media with the titanium alloy mini-implants immersed for days 15–28 and with the stainless steel mini-implants immersed for both study periods did not show statistically significant changes in the number of osteoclasts.

Conclusions. Metal ions were released from orthodontic mini-implants in the early period and declined thereafter. Metal ions released from titanium mini-implants in the early period inhibited osteoclastogenesis, while metal ions from stainless steel mini-implants had no effect on osteoclast differentiation.

Keywords: cytotoxicity, biocompatibility, osteoclast, metal ion, orthodontic mini-implant