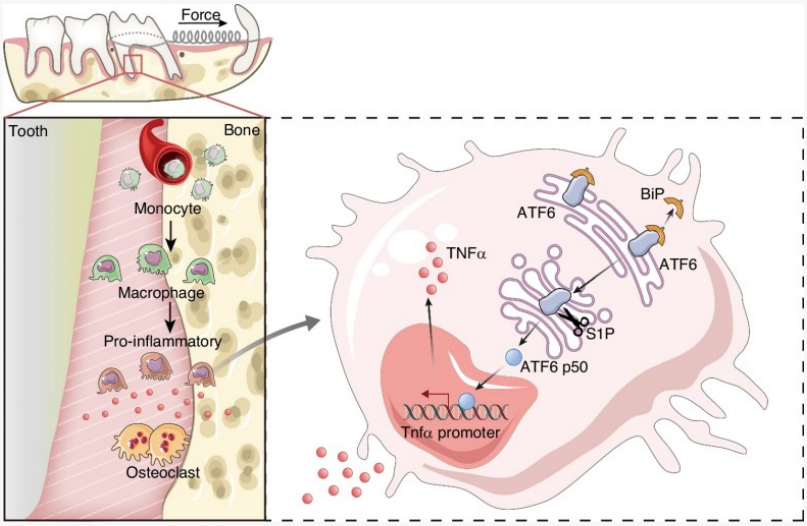
Unlocking faster orthodontic treatments: the role of atf6 in bone remodeling

GA, UNITED STATES, May 8, 2025 /EINPresswire.com/ -- Orthodontic treatments often take years, but a breakthrough discovery could drastically shorten this period. Researchers have uncovered that ATF6, a protein activated in macrophages during corticotomy, accelerates tooth movement by promoting inflammation and boosting the production of TNFα, a key factor in bone remodeling. This finding paves the way for faster, more efficient orthodontic procedures, minimizing both treatment time and patient discomfort. The study highlights the potential for non-invasive therapies that could reshape the future of orthodontic care.



This diagram illustrates the role of macrophage ATF6 in orthodontic tooth movement. When corticotomy is applied, monocytes are recruited to the bone, where they differentiate into pro-inflammatory macrophages. These macrophages activate ATF6, which then e

Corticotomy, a surgical procedure aimed at accelerating tooth movement, induces bone remodeling through a phenomenon known as the regional acceleratory phenomenon (RAP). While this technique is effective, the molecular mechanisms behind RAP are not yet fully understood. Macrophages, crucial players in immune responses and bone remodeling, have been identified as key participants in this process. However, the precise role of molecules like ATF6, which controls stress responses in cells, remains elusive. Based on these knowledge gaps, there's a clear need for more focused research to understand how ATF6 influences bone remodeling in corticotomy.

This research, led by Zhichun Jin, Hao Xu, Weiye Zhao, and their team from the Department of Orthodontics at Nanjing Medical University, was published on April 1, 2025, in the International Journal of Oral Science. The study highlights the crucial role of macrophage ATF6 in accelerating orthodontic tooth movement during corticotomy. The researchers discovered that activation of ATF6 in macrophages increases the production of TNFα, a cytokine key to bone resorption. This process accelerates bone remodeling, facilitating faster tooth movement. The study suggests

that ATF6 could be a potential target for future non-invasive orthodontic treatments, providing a path for more efficient orthodontic care.

The study used advanced murine models to explore the relationship between macrophage ATF6 and orthodontic tooth movement. Researchers found that corticotomy-induced activation of ATF6 in macrophages triggered a pro-inflammatory response, significantly accelerating the movement of teeth. The presence of pro-inflammatory macrophages in periodontal tissue indicated enhanced bone remodeling. When ATF6 was genetically knocked out in macrophages, the acceleration of tooth movement was reduced. Conversely, overexpressing ATF6 intensified the process. Further analysis revealed that ATF6 directly interacts with the Tnfα promoter, enhancing the transcription of this crucial cytokine. This discovery opens new avenues for targeted treatments that could improve the speed and effectiveness of orthodontic procedures.

"Macrophage ATF6 has proven to be a key regulator in orthodontic bone remodeling," said Prof. Bin Yan, a leading researcher involved in the study. "This protein not only accelerates tooth movement by influencing inflammation but also provides us with a new therapeutic target that could revolutionize orthodontic treatments, making them quicker and less invasive."

This research holds significant promise for the future of orthodontics. By targeting the ATF6-TNFα pathway, new therapies could be developed to accelerate tooth movement without the need for surgery. Such advancements could make orthodontic procedures faster, less painful, and more accessible. Beyond orthodontics, this study could have broader applications in bone healing and treatment for diseases involving bone loss. With further research, these findings could lead to the development of non-invasive, more effective treatments for bone-related conditions, ultimately transforming patient care across multiple fields.

References
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