Harvard School of Dental Medicine

UIC UNIVERSITY OF ILLINOIS AT CHICAGO COLLEGE OF DENTISTRY

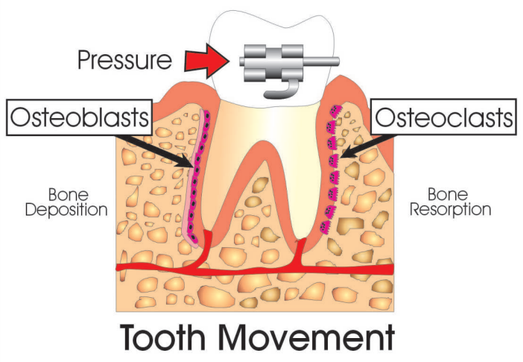
Effect of Shockwave Therapy on Orthodontic Tooth Movement

Ganjawalla K[1], Oubaidin M[2], Chen Y[2], Kelling AL[3], Evans CA[2], Atsawasuwan P[2]

[1] Dental Student, Harvard School of Dental Medicine, Boston, MA, USA
[2] Department of Orthodontics, College of Dentistry, University of Illinois at Chicago, Chicago, IL, USA
[3] Private Practice, Raleigh, NC, USA

INTRODUCTION

Tooth movement



Tooth Movement

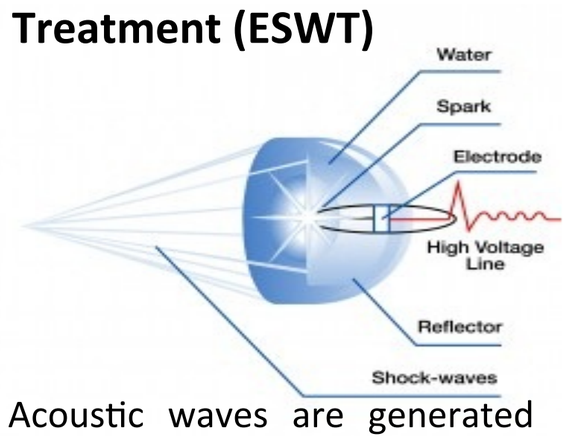
Prolonged treatment complications

- Root resorption
- Periodontal problem
- Enamel decalcification
- Compromised compliance

Approaches to modify orthodontic treatment time

- Administration of biomolecules
- Local physical treatment of alveolar bone and periodontal ligament

Extracorporeal Shockwave Treatment (ESWT)



Acoustic waves are generated by an underwater high-voltage spark, which creates single pulse waves with high-pressure amplitude, small pulse width, and short rise time.

Treatment and application

- FDA approved for musculoskeletal disorders
- Up-regulates neovascularization and osteogenic growth factor expression
- Promotes osteoblasts and fibroblasts proliferation
- Induces alveolar bone regeneration and accelerates consolidation in distraction osteogenesis

METHODS

Animals

- UIC animal protocol 12-131
- Male adult Sprague Dawley rats; 300-350 g, 9-10 weeks old.
- The animals were subjected to 10cN mesial tooth movement for 28 days with or without shockwave application.
- A single application of ESWT at a parameter of 1000 pulses at 5 Hz on the day of orthodontic tooth movement

Evaluation

- Faxitron and micro CT radiograph
- H&E and TRAP staining
- Fluorescence double labeling
- Serum biochemistry

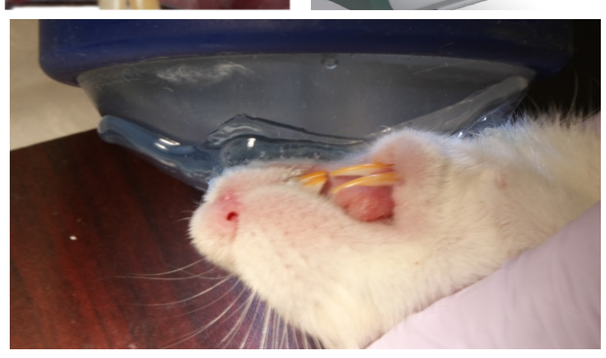


Figure 1
A. A 10cN spring was ligated from incisors to one first maxillary molar while the other side was served as a control. B. A shockwave device with focused applicator. C. Application of shockwave onto a rat. A thin layer of ultrasonic gel was applied onto the rat during the application.

RESULTS

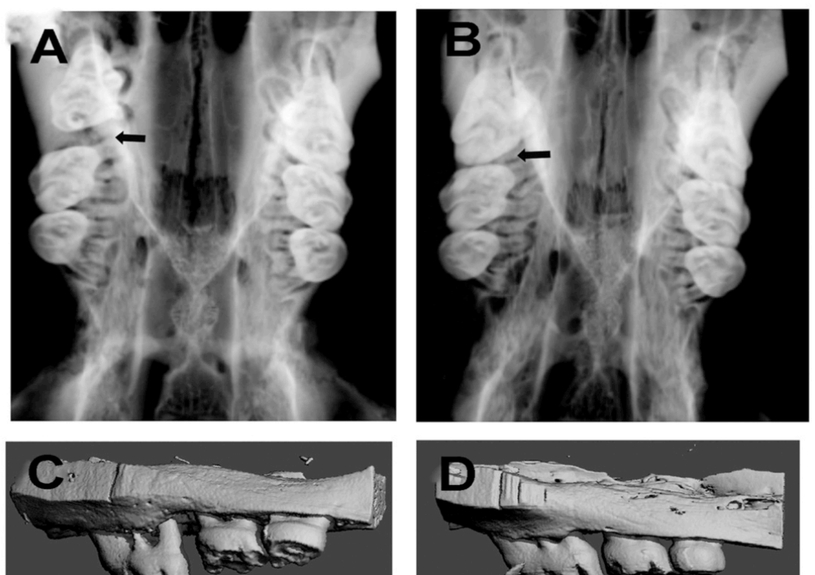


Figure 2
Faxitron radiograph demonstrated delayed tooth movement in shockwave treated group (D) compared to control (C). The same finding was confirmed by microCT (E, F). The significant difference between groups was found at day 28 (*P<0.05).

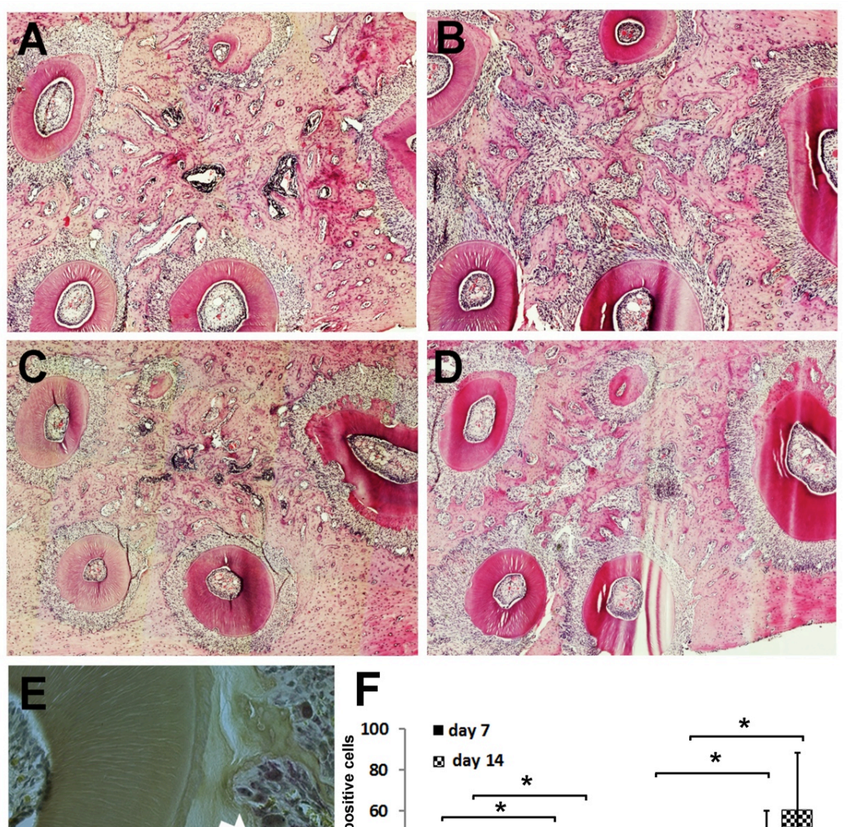
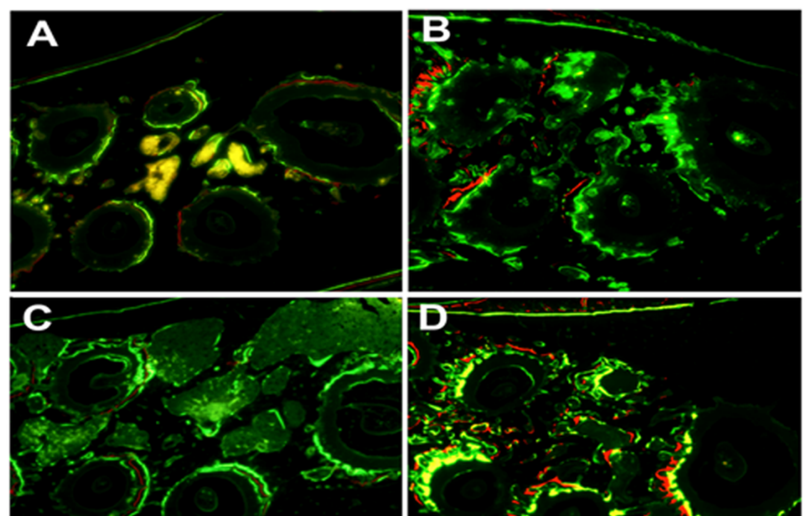


Figure 3
H&E staining sections showed increased number of osteoclasts and bone resorption in tooth movement only (B) and tooth movement with shockwave (D) compared to no loading (A) and no loading with shockwave (C). The arrow shows TRAP+ cells as osteoclasts (E). The number of osteoclasts in each group was demonstrated (F) (* P<0.05)



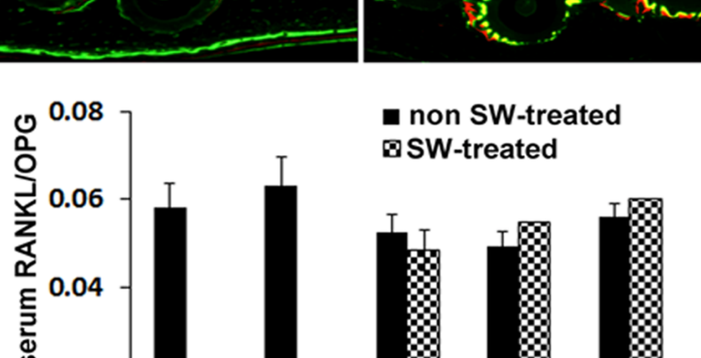


Figure 4
Fluorescence double staining demonstrated increased bone forming in tooth movement (B) and tooth movement with shockwave (D) compared to no loading (A) and shockwave only (C). The ratio of serum RANKL/OPG showed no difference between groups (E).

CONCLUSION

ESWT delays orthodontic tooth movement in rats and promotes osteoblast and osteoclast differentiation. ESWT exhibits no systemic effect on the rats' osteoclasts after a single application

FUNDING SOURCE

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