



The Effect of NSAIDs on The Bone Healing Process in Rats

Introduction

NSAIDs: Non-Steroidal
Anti-Inflammatory
Drugs

Most commonly used to
treat:

- muscular and
skeletal pain
- arthritis
- menstrual cramps
- headache



Figure 1

NSAIDs

Common NSAIDs

Aspirin

Ibuprofen

-Advil

-Motrin

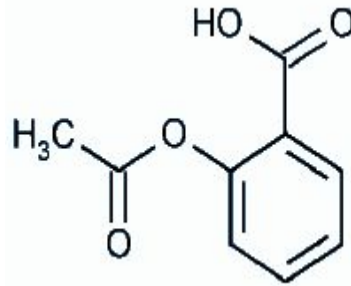
Naproxen

-Aleve

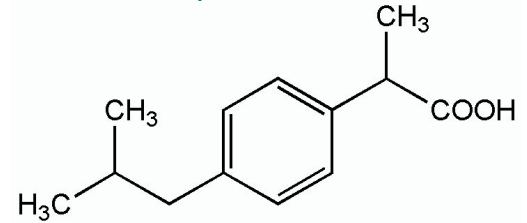
Celecoxib

-Celebrex

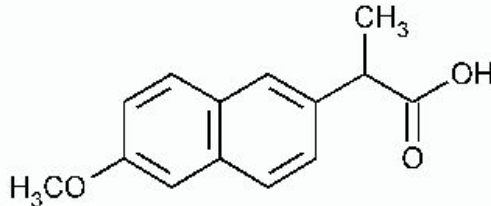
Aspirin



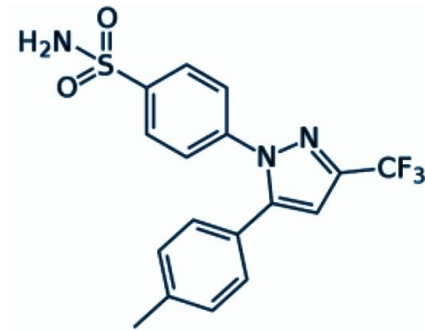
Ibuprofen



Naproxen



Celecoxib



NSAID Function

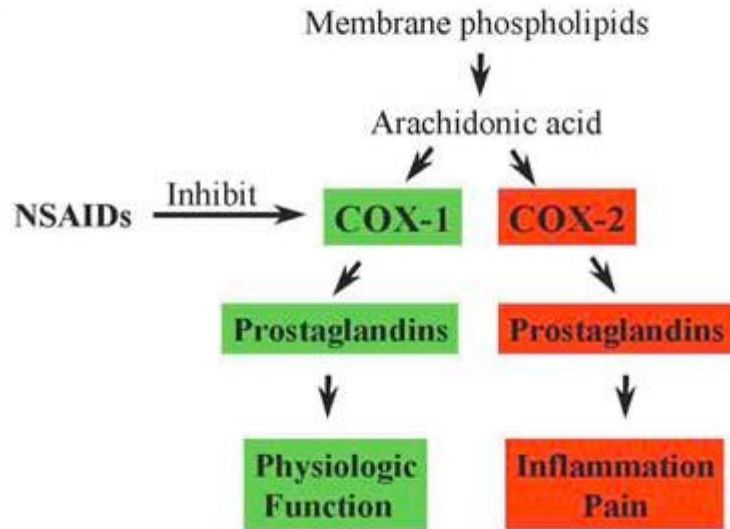


Figure 7

- Arachidonic acid forms prostaglandins with presence of cyclooxygenase (COX)
- Prostaglandins are required for inflammation
- NSAIDs inhibit COX

The Cyclooxygenase Enzymes

- 2 forms of COX: COX-1 and COX-2
- NSAIDs are non-selective and selective
- Crystal structures are same in humans, rats, mice, and sheep

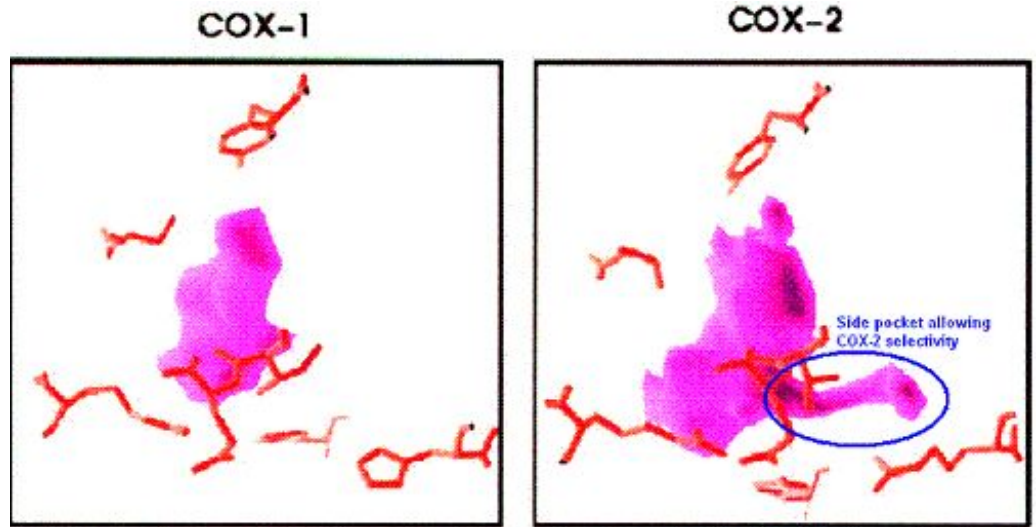


Figure 8: T. Williams, 2007

NSAIDs and Prostaglandins

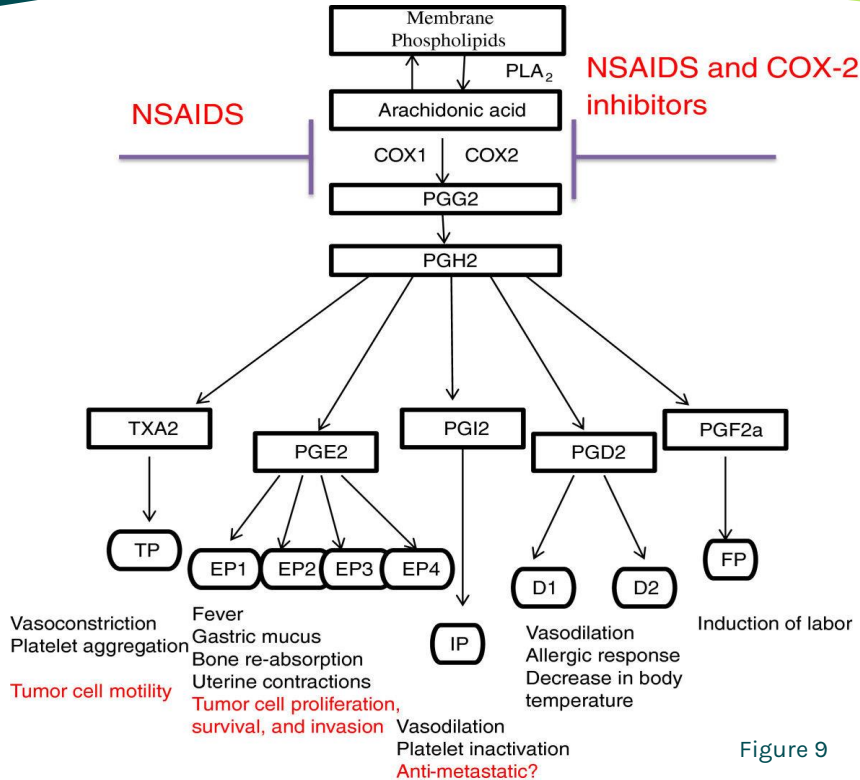


Figure 9

- Different types of prostaglandins
- PGE2 is associated with bone resorption
- Gastrointestinal effects of NSAIDs

Bone Homeostasis

- Osteoblasts and osteoclasts are in constant balance
- Osteoblasts form bone with Ca^{2+}
- Osteoblasts absorb bone and return Ca^{2+}

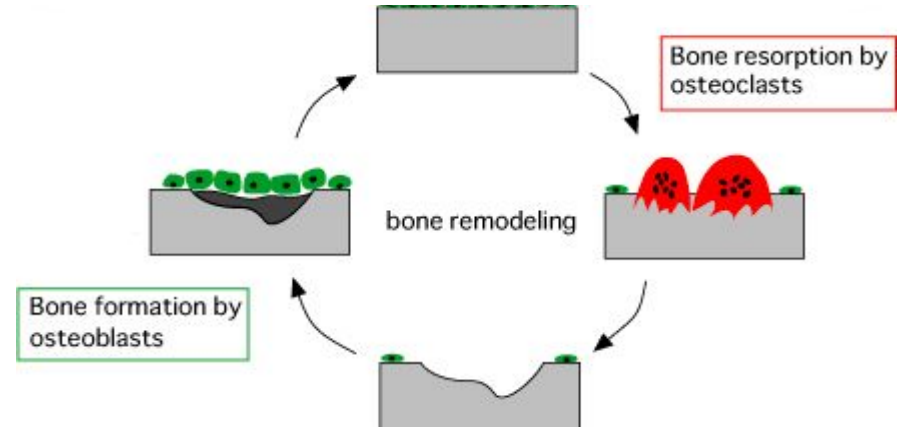


Figure 10

Purpose

To investigate the process of NSAID interaction in the body and their role in the bone healing process

Research Question

Do NSAIDs have adverse effects on the bone healing process?

Alternative Hypothesis

NSAIDs inhibit and delay the bone healing process by inhibiting the COX enzymes

Null Hypothesis

NSAIDs have no effect on bone healing

Methods

- Systematic review
 - PubMed, Medline, PLOS, Journal of Biological Chemistry, Journal of Bone and Mineral Research
- Data collection
- Statistical analysis of data
 - Mean, Standard deviation, Chi Square

Results

Percentages of Rats in Studies With Bone Healing Complications Due to the Use of NSAIDs Resulting in Low Osteoblast Count

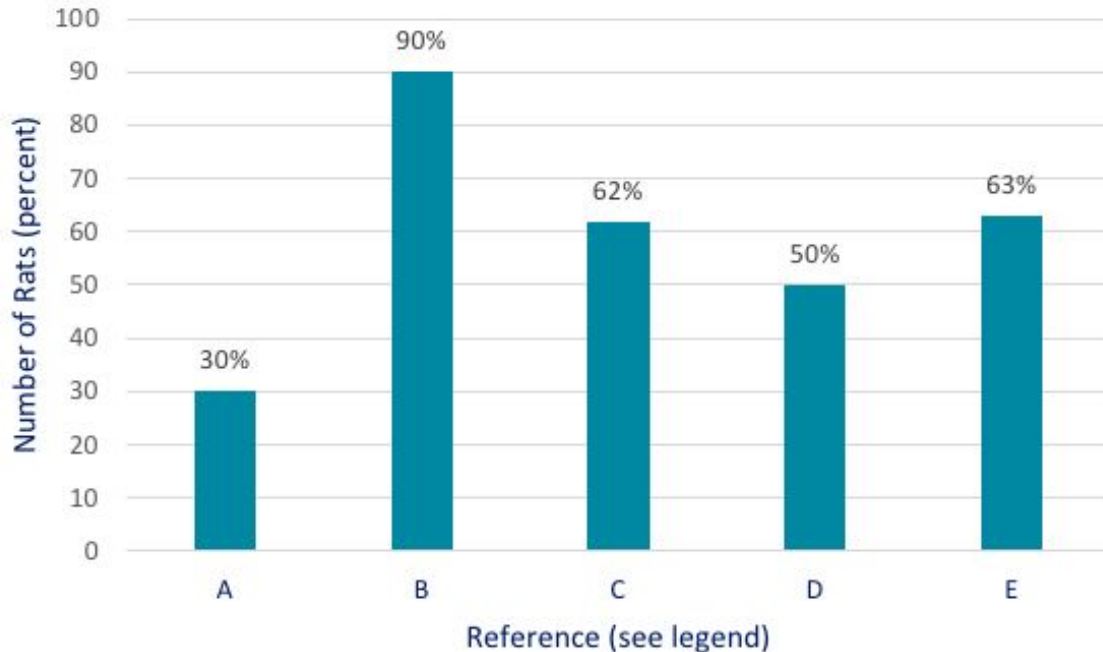


Figure 11

A: P. E. Persson, G. Sisask, and O. Nilsson, 2005

B: E. Sudmann and G. Bang, 1979.

J. R. Dimar II, W. A. Ante, Y. P. Zhang, and S. D. Glassman, 1996

C: H. L. Allen, A. Wase, and W. T. Bear, 1980

D: T. Karachalios, L. Boursinos, L. Poultsides, L. Khaldi, and K. N. Malizos, 2007

E: K. D. Riew, J. Long, J. Rhee et al., 2003

Results

Average Bone Strength During Various Mechanical Testings

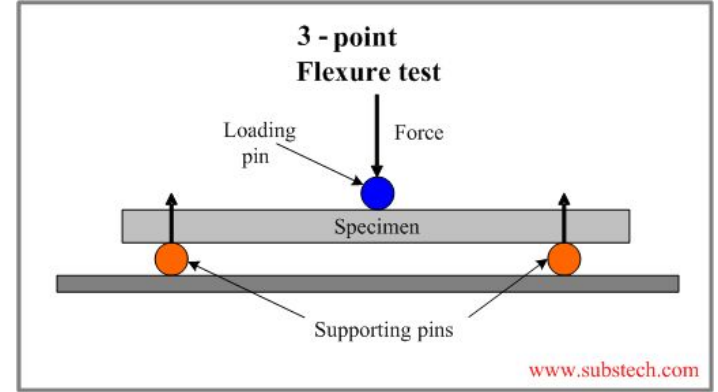
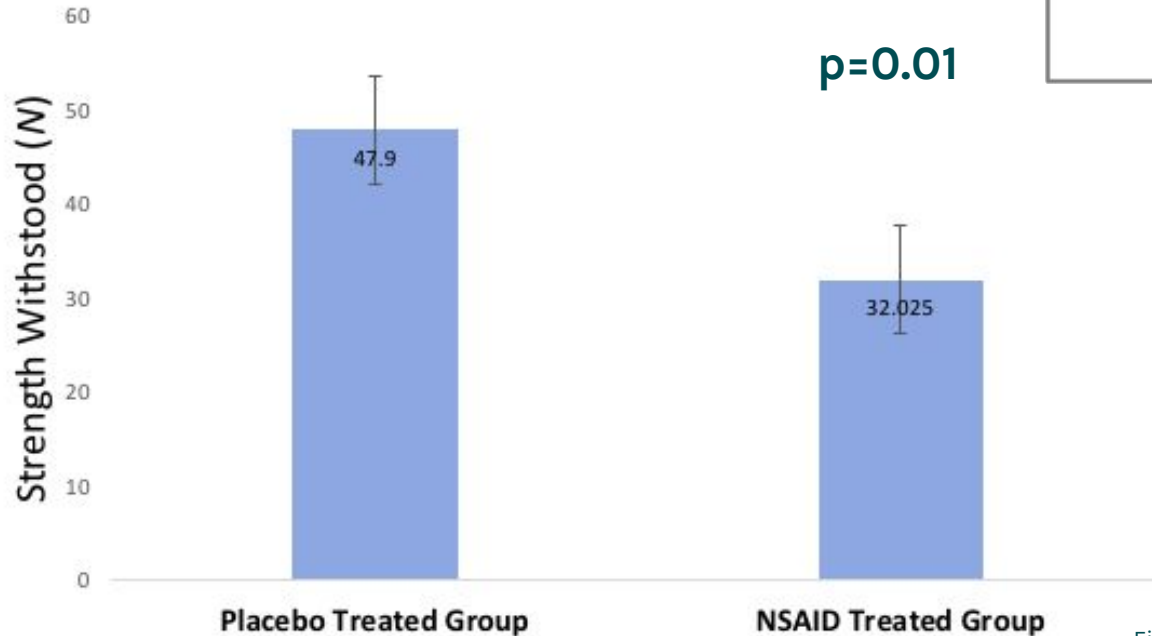


Figure 13

Figure 12

Results

Average Bone Stiffness During Various Mechanical Testings

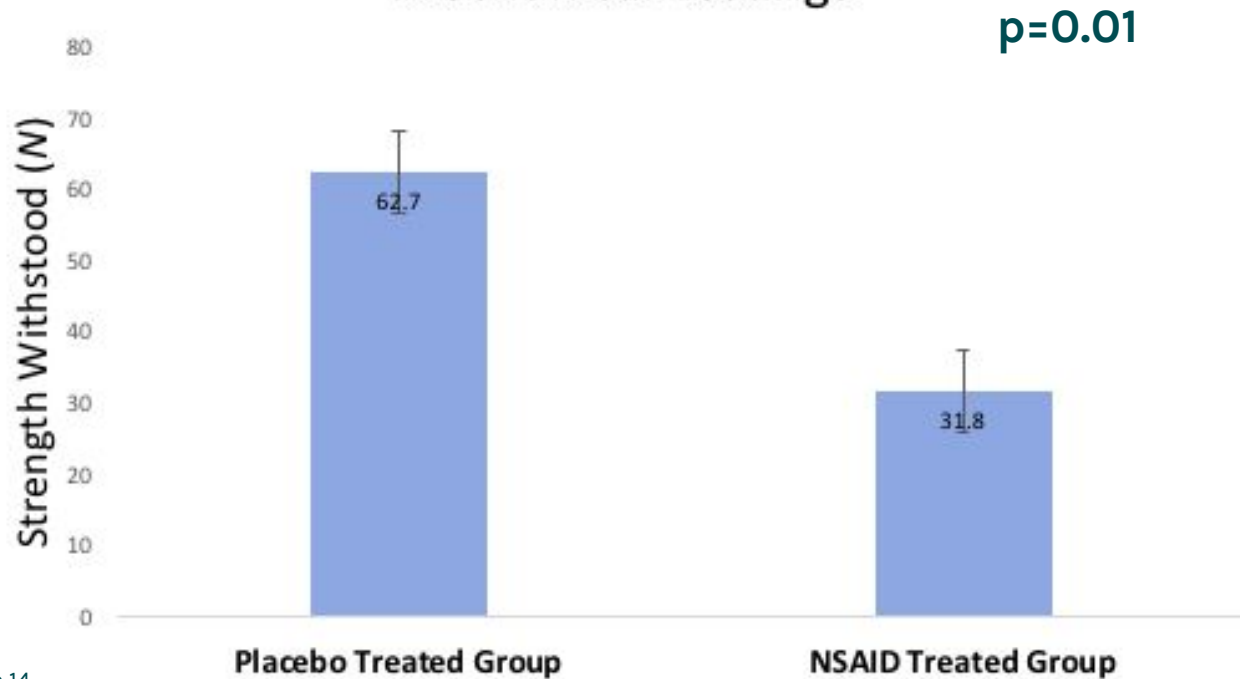


Figure 14

Sources of Error

- Access to online journals
- Studies with same tests and units
- Studies with same NSAID tested

Discussion

- Average Chi Square test result of $p=0.01$
- Lower osteoblast count in NSAID treated rat groups
- Lower force of strength withstood in NSAID treated rat groups
- Lower stiffness (density) level in NSAID treated rat groups

Conclusion

- NSAIDs slowed down bone healing
- Inhibition of COX results in lower osteoblast count
- Decrease in bone density (strength and stiffness)

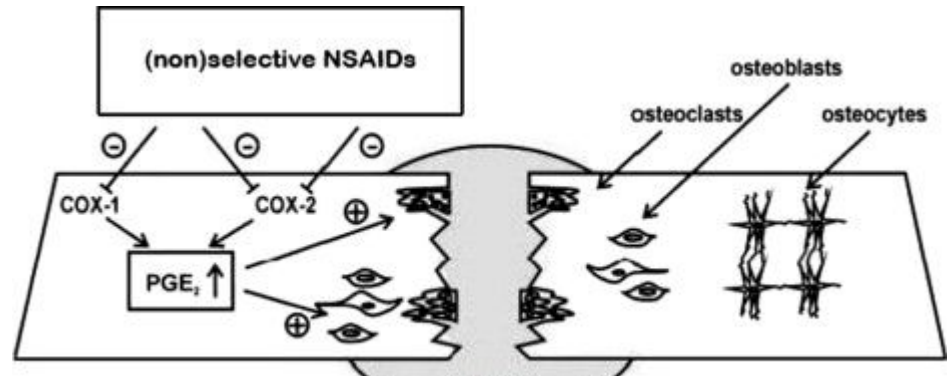


Figure 15

Further Work

- Time it takes for healing with NSAIDs vs. without
- Application of research for arthritis patients

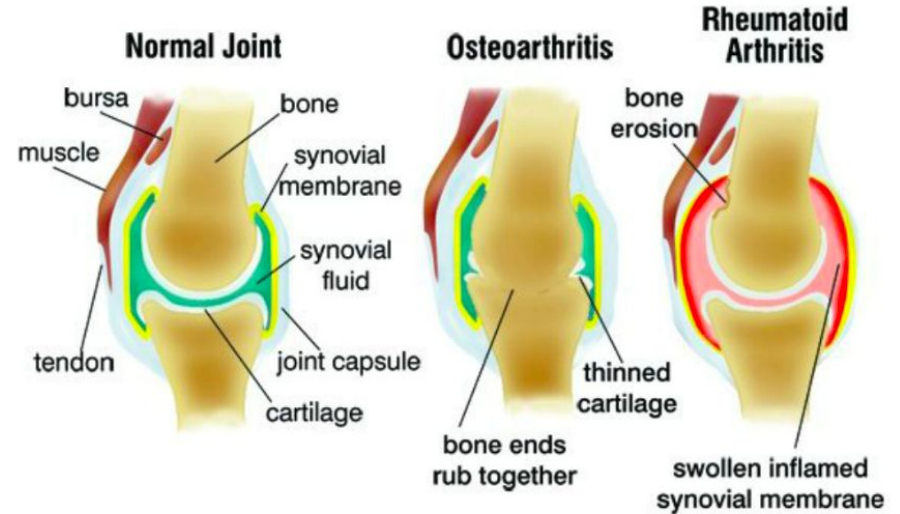


Figure 16

Acknowledgements

Dr. Nikki Malhotra

Dr. Robert Deamer

Dr. Kimberley Caputo

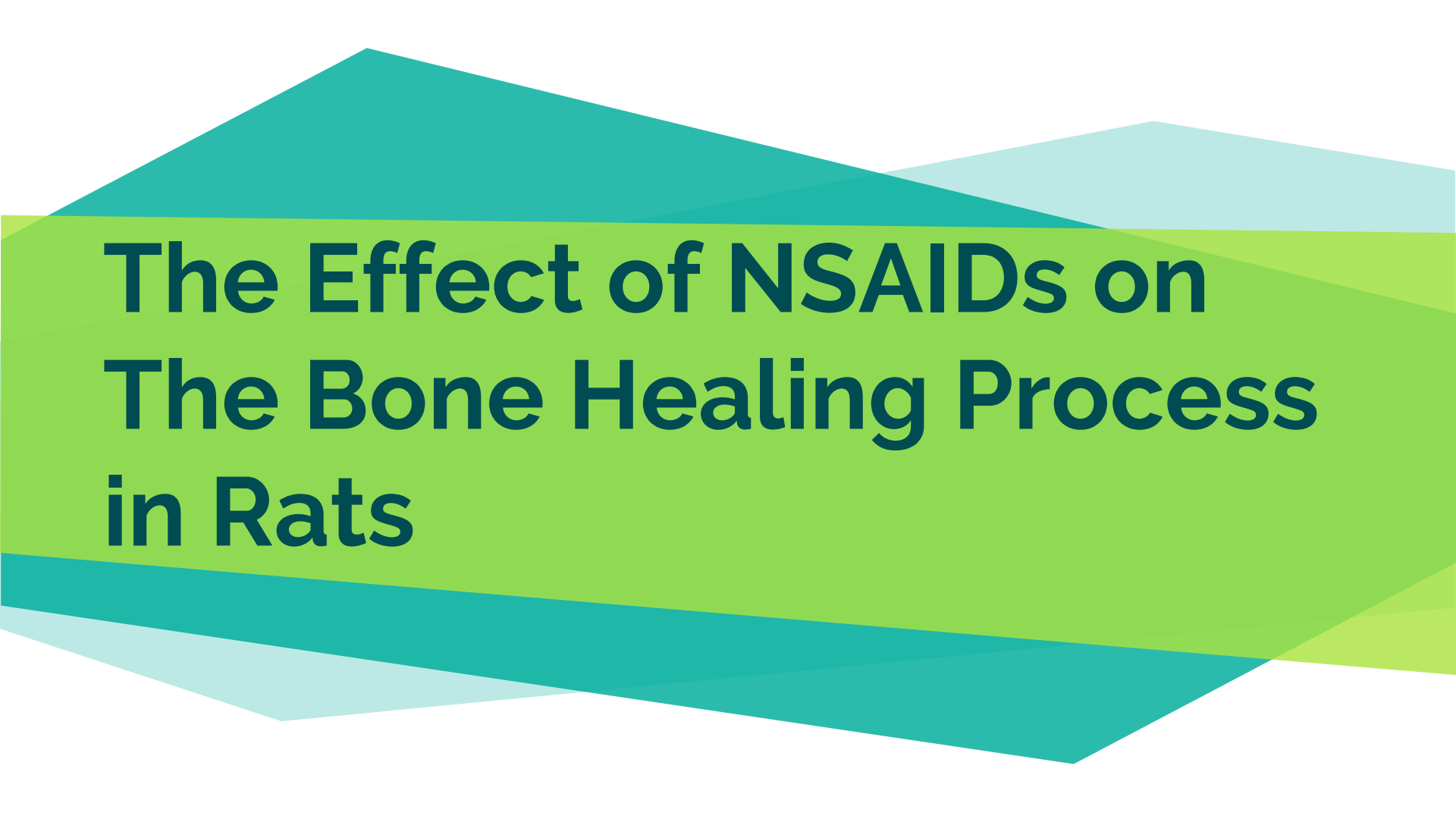
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