Testing the Efficacy of Targeted Anabolic Agents on Maxillofacial Defects in a Rodent Model

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Introduction

Maxillofacial Surgeries are often debilitating, requiring constant monitoring of the patient, and putting the patient through excruciating pain for 6 to 8 weeks[1]. These surgeries have relapse rates of up to 20%[1], requiring a repeat-surgery. For these patients there is a great need to accelerate healing and minimize pain.

Anabolic agents produced in the body have shown great effect on bone growth[2], but with moderate efficacy when systemically administered. The use of targeted analogues of such agents allows for an increased desired effect while minimization of side-effects.

Objectives

- Evaluate the efficacy of AbalodE20
- Evaluate healing in flat bones instead of long-bones
- Connect healing to clinical relevance.

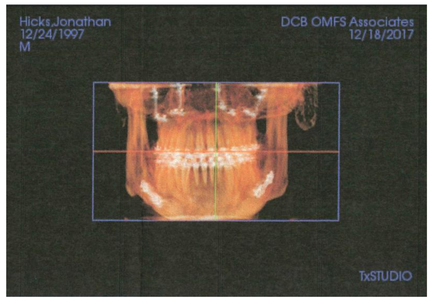


Fig. 1: Example Maxillofacial Osteotomy CT scan

Methods

- 6 rats underwent mandibular osteotomy
- Split equally into Saline and AbalodE20 groups
- Jaw was broken and stabilized with a surgical plate.

µCT data was collected at 14 and 21 days. At 21 days, mandibles were collected and re-broken for force data.

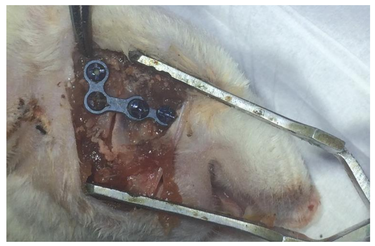
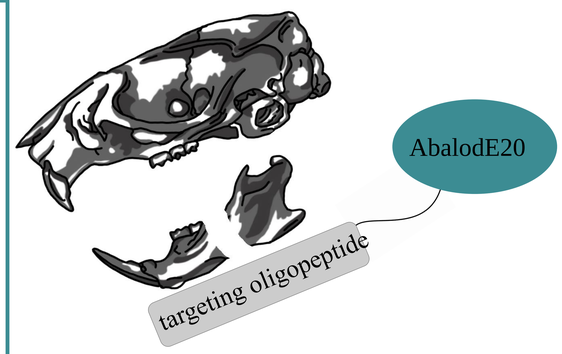
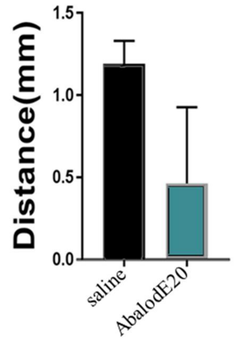


Fig. 2: Surgical Implantation of a support plate after osteotomy



Two Week Fracture Distance



Three Week Fracture Distance

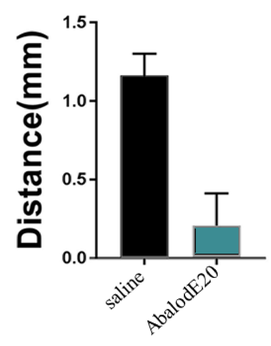


Fig. 3 [3] (left): A negatively charged bone mineral targeting oligopeptide is used in order to deliver Abalo to the exposed fracture site on the jaw. Fig. 4 (right): Gap measurements of the sample jaws at 14 and 21 days

Saline **AbalodE20**

14 days

21 days

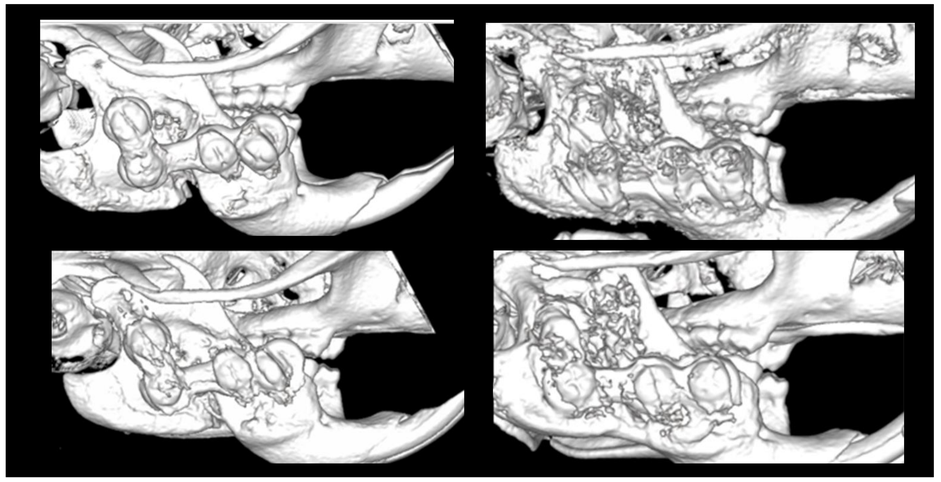
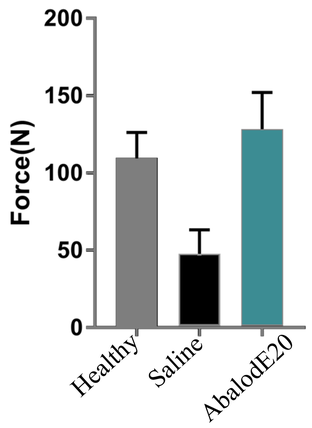


Fig. 5: µCT scans at days 14 and 21, representative images of the groups

Max Load Sustained



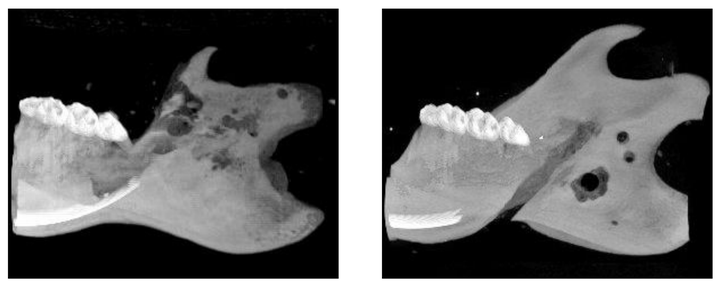


Fig. 6 (left): Force analysis on bone strength between unbroken mandibles, negative control, and treatment group
Fig. 7 (above): Final scans of rat jaws. Saline (right) did not heal nearly as well as AbalodE20 (left).

Discussion

- Statistically higher force sustained with AbalodE20(p=0.046)
- Statistically different gap size at three weeks(p=0.009)
- Healing was not only faster, but stronger
- Animals were in pain for minimal time(<7 days)
- Minimal complications

Conclusions

- More studies needed to increase sample size
- Huge clinical relevance
- Allows for patients to return to life faster
- Allows for higher quality of life during healing
- Promise is shown in maxillofacial cases, as well as other broken bones

References

[1] E. P. Buchanan, "Lefort I Osteotomy," *Semin. Plast. Surg.*, vol. 27, no. 3, pp. 149–159.
[2] S. Low, "Targeting polymer therapeutics to bone," *Adv. Drug Deliv. Rev.*, vol. 64, no. 12, pp. 1189–1204, Sep. 2012.
[3]

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