

INTRODUCTION

In recent years, the use of botulinum toxin (BT) injections around the temporomandibular region has been increasing among dentists and other clinical professionals for treating chronic orofacial pain and movement disorders, such as masticatory muscle pain, trigeminal neuralgia and sleep bruxism.¹ The temporary paralytic effect of the toxin on masticatory muscles aids in alleviating orofacial pain associated with these disorders or may help cease undesirable muscular contractions, as in sleep bruxism.² The use of BT type A is also growing in popularity for the aesthetic and cosmetic alterations it induces.³

There is some evidence to show the degenerative effects on surrounding skeletal structures, particularly around the mandibular condyle.¹ Condylar resorption occurs mainly due to trauma, inflammatory conditions and impaired circulation.⁵ Studies show that BT reduces the contractile forces for 3-6 months (possibly longer) after repeated injections.⁶ The reduction in bone mineralization of the condyle attributed to BT is likely due to reduction in contractile forces. Other studies which have investigated the effect of BT injection into the masticatory muscles show a linear relationship between dose of BT (20U to 100U) into the masticatory muscles and reduction in bone mineralization in the condyle and coronoid area.

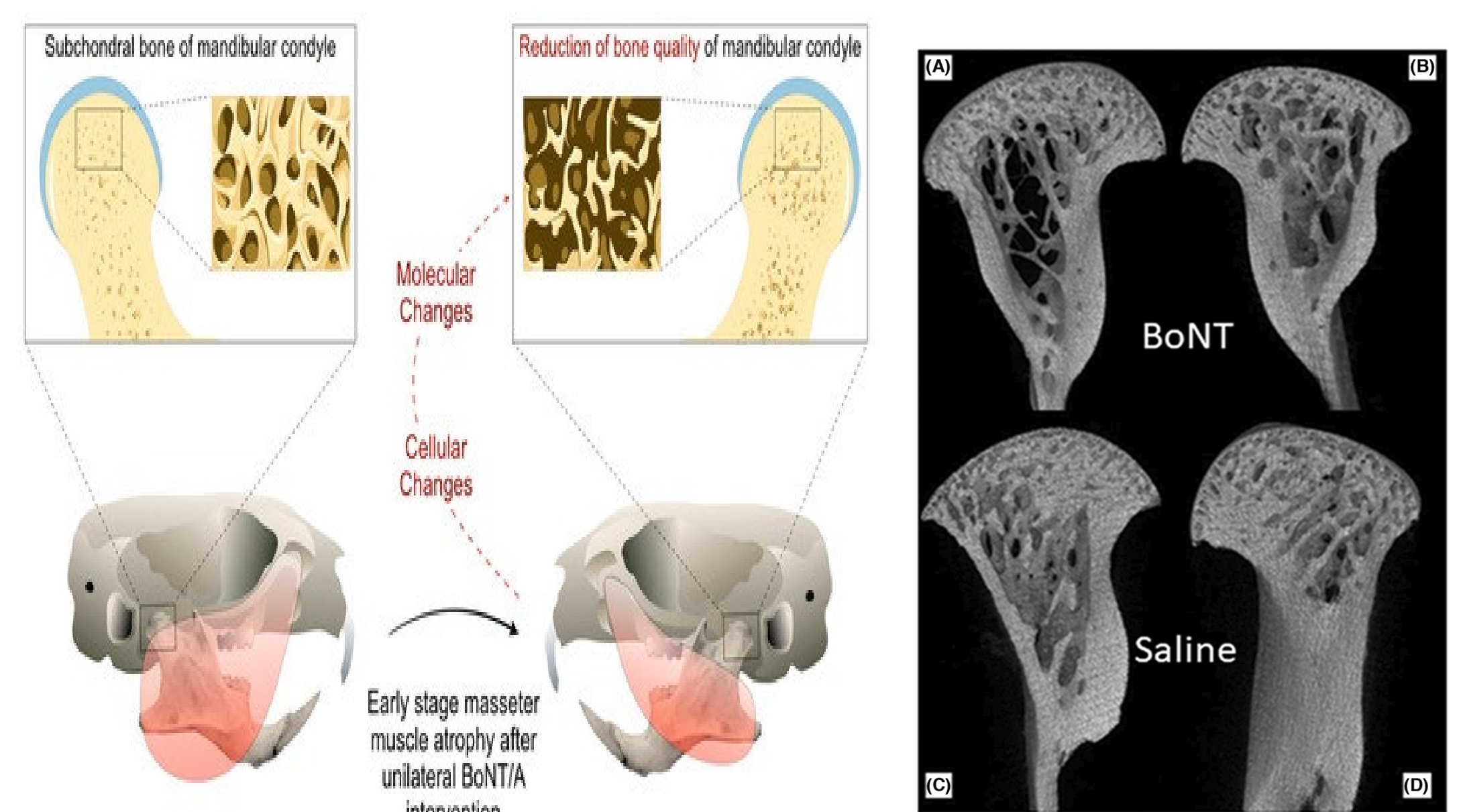
Review of Data

- There are 13 animal studies (mice, rabbits) which investigated the relationship between Botulinum toxin injection into the masseter and changes in mandibular bone.
 - There was consistent (most trials) observed reduction in cortical thickness/bone mineralization in the condylar area at 2 weeks to 7 weeks follow up.
 - One study showed reduced ramus height.
 - Two studies showed decline in alveolar bone.

Human Studies of Botulinum Toxin injections into the Masticatory muscles

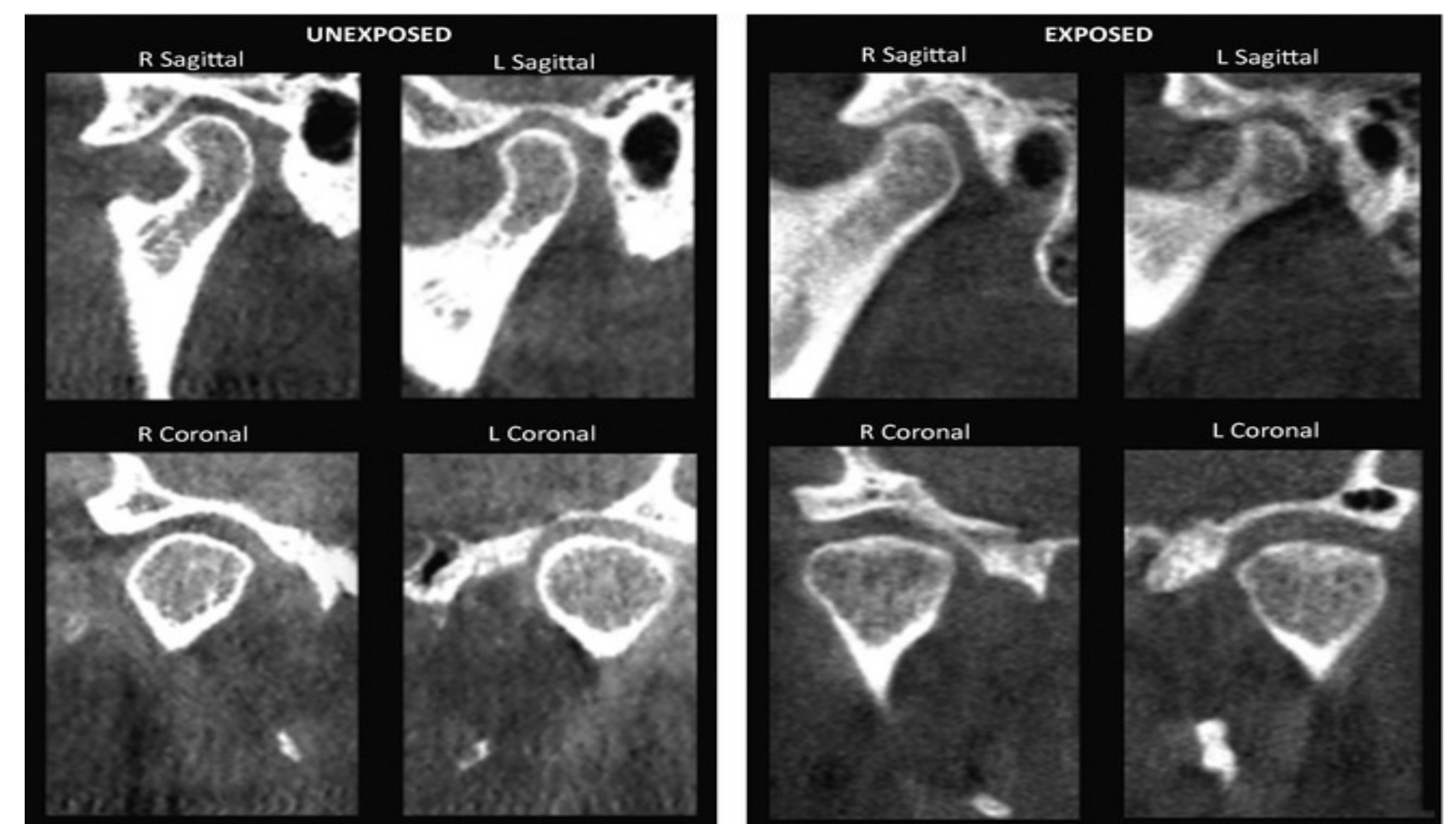
Authors	Dosage of BT/A administered	Follow up	Bone evaluation technique	Results
Chang et al, 2011	120 U BT/A in both masseters	3 months	CT - 3D evaluation	No significant changes in the bony makeup
Raphael et al, 2014	Unreported	6-10 weeks	Cone-beam CT (CBCT)	Decrease in trabecular density observed in the experimental group
Lee et al, 2017	25 U BT/A bilaterally masseter muscles	6 months	CBCT scan - bone	Significant decrease in the bone volume of the mandibular gonial area in experimental group
Aziz et al, 2017	140 U injected in left masseter	7 months	Dynamic MRI	Severe degeneration of left condyle
Kahn et al, 2020	50 U BT/A bilaterally in both masseter and temporalis muscles	12 months	3D CBCT	Increased non-uniformity in alveolar and condylar bone, along with cortical thinning of right condyle
Raphael et al, 2020	Variable dosage and location	variable	3D CBCT	Increase in BT/A dosage showed a reciprocal relationship with trabecular density in the mandible
Hong & Kang, 2020	Bilateral injection of 20 U and 25 U of BT/A in temporalis and masseter muscles, twice at a 6-month interval	12 months	3D CBCT	Reduced cortical thickness in region of interest among participants in the experimental group
De la Torre Canales et al, 2020	Bilateral injection of 3 distinct levels of BT/A doses (low, medium, and high) in the masseter and temporalis muscles	3 months	3D CBCT	Decline in bone volume at the coronoid and condylar regions observed as a function of dosage

ANIMAL AND HUMAN STUDIES



Mouse model of mandibular condyle degradation during the early stage (2 weeks) of BoNT/A-induced masseter muscle atrophy in adult animals.¹

Reduction in condylar bone density in female rabbits injected with botulinum toxin vs. those injected with saline.⁷



Cone-beam computed tomography derived images of bilateral condyles in patients exposed to multiple masticatory muscle injections with botulinum toxin vs unexposed patients.⁸

CONCLUSION

There seems to be clear data showing a negative impact of BT injection into masticatory muscles (mainly the masseters) and the bone mineralization of condyles. What is unclear is whether this detriment in bone mineralization is progressive. It does seem that the reduction in bone mineralization continues for a few months beyond the clearance of BT. In patients who exhibit any detrimental changes (reduced mineralization) in the condyles, coronoid process or other areas of masticatory muscle attachments, risks and benefits should be cautiously weighed before making a decision to use BT as a treatment modality. In patients who have a history of arthropathies of the temporomandibular joint (TMJ) (osteoarthritis, psoriatic arthritis, trauma, spondylising arthritis and rheumatoid arthritis), a proposed protocol is imaging of the TMJ prior to BT injection especially into either the temporalis, masseters or both.

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