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**HISTOMORPHOMETRIC ANALYSIS OF THE
TEMPOROMANDIBULAR JOINT CONDYLE
IN YOUNG AND MATURE SHEEP**



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ABSTRACT

Much of the literature regarding arthrotic changes in the Temporomandibular Joint (TMJ) is based on the assumption, rather than the demonstration, that joint degeneration is pathologically and biochemically similar to that which has been described for other arthrodial joints. Understanding such changes is axiomatic of an understanding of the specific histomorphometric structure of the normal TMJ, in particular the condyle. Unfortunately, very little has been established about the trabecular bone and cartilaginous morphological patterns in the mandibular condyle as it develops during growth. As a consequence of the obvious practical difficulties in investigations of the human TMJ, the sheep has been variously used as an animal model. In order to augment a fuller characterisation of this animal model, this study focuses on the qualitative and quantitative histomorphometries of the trabecular bone and cartilage in the mandibular condyles of young and mature sheep.

Histomorphometric analyses of cartilage and trabeculae from mature and young sheep condyles were performed on histological sections stained with a modified blue Masson's trichrome and light green Masson's trichrome respectively. Digital photomicrographs of lateral, central & medial sagittal sections, and anterior & posterior coronal sections of the condyle were taken and then analysed using a public domain software programme (ImageJ 1.33u) to measure cartilage thickness as well as a Quantimet 500MC image analysis system programmed to measure 1) cartilage matrix and cellularity of the condyle and 2) structural index values of trabecular bone volume, surface, thickness, separation and number.

The results from this project found that there were strong variations in the range of qualitative morphology seen of both cartilage thickness and cellularity as well as trabecular bone morphology. Analysis of histoquantitation data revealed: 1) a significant decrease in the thickness of the Fibrous Zone, Hypertrophic Zone and Total Thickness of the central region as compared to the lateral and medial regions in the mature sheep, 2) a trend toward a higher cellular component (decreased matrix) in the young sheep as compared with the mature sheep condylar cartilage, and 3) a significant concordance in bone structural index values between lateral, central and medial regions in young and mature sheep as well as anterior and posterior regions in young sheep.

This study provides the first comparative histomorphometric analysis of cartilage and trabecular bone in the mandibular condyle of both young and mature sheep. The findings from this study reinforce the notion that there is constant remodelling of both the condylar cartilage and trabecular architecture throughout growth and development in the postnatal sheep, as well supporting the role of the sheep as a model in studies of the TMJ. Although there is a trend to a reduction in the cellularity of the condylar cartilage with age, a high cellular state still exists in the mature sheep indicative of such continuing growth and regeneration potential. As the thickness of condylar cartilage did not change with increasing age, this is indicative of the importance of cartilage as a method of transferring load to the bone. Nevertheless, the results do suggest that the central region, compared to the poles of the TMJ, has the greatest loads placed upon it over time resulting in increased wear. Finally in regards to the bone as an effective mechanism of distributing load, although qualitative morphological differences with trabeculae aligning perpendicular to the articular surface are seen, quantitatively our results insinuate that it is the distribution of bone, rather than an increase in the quantity of bone that changes with age.