

# Quantitative assessment of articular cartilage degeneration of the metacarpal condyle using a 3D scanning system

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## Introduction

Staining cartilage surfaces with Indian ink is used to detect surface fibrillation and proteoglycan depletion. Brommer et al. (2003) developed the Cartilage Degeneration Index (CDI) as a quantitative measurement for cartilage degeneration over the entire proximal articular surface of the proximal phalanx (P1). The goal of the present study was to obtain a CDI for the articular cartilage of the metacarpal condyle (MC3) using a novel 3D scanning technique.

## Materials and Methods

twelve fetlock joints, 6 from young (3 years old) and 6 from older (20 to 25 years) Warmblood horses, were harvested immediately after slaughter.

A stereo triangulation scanner was used to acquire full 3D models before and after staining. P1 and the MC3 were mounted vertically in a clamp on a computer-controlled turntable. Scans were made at 5 degree intervals and were automatically assembled. Consecutively, the operator selected the cartilage region using a paintbrush metaphor and the surface area of the selected cartilage was measured based on the 3D geometry. Each manual selection was repeated 5 times. Based on the average ratio between stained and unstained gray values, the CDI (i.e. percentage of darkening) was calculated. Differences in surface area and CDI between the younger and older horses and between P1 and MC3 were analyzed using a GLM procedure for repeated measurements (SPSS 17.0;  $\alpha = 0.05$ ).

## Results

CDIs ranged from 10.72 to 36.31%. CVs of CDI were below 2%. There was no significant difference between the repeated measurements for surface area and CDI ( $P = 0.421$  and  $0.098$ , respectively). No significant difference was seen between younger and older horses for surface area and CDI ( $P = 0.915$  and  $0.842$  respectively). The CDI of P1 and MC3 were not significantly different ( $P = 0.249$ ).

## Conclusion

This novel 3D scanning system allowed the calculation of CDI values of the distal metacarpal condyle, an area previously left unexplored because of the complex geometry of this region. Further research is now possible to elucidate the cartilage status of the metacarpal condyle in sound and diseased horses.

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