COMPARISON OF THE ICRS VERSUS HHGS (MANKIN) CARTILAGE HISTOLOGY SCALES

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Purpose: Recently, the International Cartilage Repair Society (ICRS) has devised a visual histological scale for assessing cartilage repair at the sites of cartilage lesion. The ICRS scale assigns scores based on surface roughness, nature of repair tissue, cell distribution, cell population viability, and possible subchondral bone remodeling and cartilage mineralization at the site of repair. The values for this scale range from zero to eighteen, representing the full range from lack of repair to complete cartilage repair. This repair-specific scale has as yet seen very limited use. In the current study, scores assigned based on the ICRS visual histological assessment scale were compared to values assigned to the same images based on the more well established histological/histochemical grading scale (HHGS) devised by Mankin et al. While not specific to cartilage repair, the HHGS has been widely used to assess cartilage repair based on formation of repair tissue with normal tissue characteristics, including surface smoothness, cationic staining, cell distribution, and integrity of the tidemark.

Methods: Histology samples were collected from cadavers and (with prior IRB approval) from patients undergoing total joint arthroplasty. After de-calcification and paraffin embedding, 5 µm thick sections were stained with safranin-O/fast green and hematoxylin using standard techniques. Stained sections were then scanned with a microscope-mounted camera coupled with a stepper motor driven stage. A graphic user interface (GUI), developed in the widely used Matlab® programming environment, saved scores assigned by each observer (Fig. 1). Seven experienced human observers independently scored 30 images each. Linear regression was used to compare Mankin HHGS scores to ICRS scores.

Results: Comparisons between the HHGS scores and ICRS scores demonstrated a reasonable monotonic relationship, with the linear regression having a slope of -0.99, near to the ideal value of -1.29 (-18/14). In addition, the HHGS and ICRS values had a Pearson’s correlation of -0.76, indicating a reasonably strong relationship (Fig. 2). Also, the absolute variance of the ICRS scores (25.54) was larger than that of the HHGS scores (12.94), but that difference was not statistically significant when the variances were normalized to their respective score ranges.

Conclusions: The scored images did not specifically include sites of cartilage repair, but they exhibited the full range of features incorporated in the ICRS scale. While by no means above criticism, the HHGS is historically the most widely used cartilage histology scale, constituting a logical standard against which new assessments can be evaluated. The slope of the linear regression line between ICRS and HHGS deviated from its ideal value, indicating a higher tendency for cartilage to be rated more normal by ICRS than by HHGS. A possible explanation is that ICRS incorporates additional features not encompassed in HHGS, including changes in the subchondral bone and abnormal cartilage mineralization at the site of cartilage repair.

OSMOLARITY INFLUENCES CHONDROCYTE DEATH IN WOUNDED ARTICULAR CARTILAGE

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Purpose: Mechanical injury results in chondrocyte death in articular cartilage. The objective of the study is to determine whether medium osmolarity affects chondrocyte death in wounded articular cartilage.

Methods: Osteochondral explants (n=48) harvested from the metacarpophalangeal joints of three-year old cows (N=6) were exposed to media with varying osmolarity (0-480 mOsm) for 90 seconds to allow in situ chondrocytes to respond to the altered osmotic environment. Explants were then wounded through the full thickness of articular cartilage with a fresh scalpel, incubated in the same media for 2.5 hours and transferred to 340 mOsm Dulbecco’s Modified Eagle’s Medium (DMEM, control medium) with further incubation for 7 days. Low power (x10) con-