The Cartilage Autograft Implantation System (CAIS) is being investigated in the US as a primary surgical treatment of articular cartilage lesion(s) located on the femur (medial and lateral condyles or trochlea). CAIS involves preparation and delivery of a minced, autologous cartilage tissue-loaded scaffold the site of cartilage lesion(s) within a single surgical procedure. This study is designed to assess safety and initial performance.

Methods and Materials: Disposable instruments consisting of an arthroscopic device for harvesting and mincing cartilage tissue, disposable singletip cannulae, scaffold cartridges, wash device and optimized. This multicenter, randomized, pilot clinical study (6 sites) may enroll up to 30 subjects. Subjects are randomized in a 2:1 schema (CAIS: microfracture (control) procedure). Subjects return for follow-up at 1 and 3 weeks, 2, 3, 6, 9 and 12 months post-operatively. Subjects are clinically evaluated and interviewed regarding the occurrence of adverse events and asked to complete questionnaires regarding disability, function, pain and quality of life. MRI are completed at baseline, 3 weeks, 6 and 12 months.

Results: In vitro studies show efficient harvest of viable tissue with no loss of outgrowth performance equivalent to previous published methods. Safety and performance of both clinical study arms will be reported through 6-months.

Conclusions: The instrumentation enabled the successful preparation and fixation of a minced autologous cartilage tissue loaded implant in an in-loading had no effect. CAIS device was safe and optimized. This multicenter, randomized, pilot clinical study (6 sites) may enroll up to 30 subjects. Subjects are randomized in a 2:1 schema (CAIS: microfracture (control) procedure). Subjects return for follow-up at 1 and 3 weeks, 2, 3, 6, 9 and 12 months post-operatively. Subjects are clinically evaluated and interviewed regarding the occurrence of adverse events and asked to complete questionnaires regarding disability, function, pain and quality of life. MRI are completed at baseline, 3 weeks, 6 and 12 months.

Conclusions: When compared to control, in-vitro chondrogenesis is most efficient when simultaneous stimulation with dynamic compression and shear, combined with BMP-2, is applied.

The combination of dynamic compression and shear with rhBMP-2 for in-vitro cartilage tissue engineering

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Purpose: Both bioreactor conditions and gene therapy have shown to enhance chondrogenesis. The purpose for this study was to compare the effects of dynamic compression and shear, or no shear in combination with retrovirally expressed bone morphogenetic protein 2 (BMP-2), on chondrocytes in vitro.

Methods and Materials: Primary bovine chondrocytes were either retrovirally transduced with BMP-2 or left untreated. Cells were seeded in 3-D polyurethane scaffolds (n=48) and further cultivated under static conditions or exposed to defined dynamic compression and shear in a joint specific bioreactor. One week after seeding four groups were investigated: G1-untreated, G2-BMP-2-infected, G3-undifferentiated + load and G4-undifferentiated + load each at three time points (d7, d21, d35). Outcome measurements included wet weight, DNA-content, glycosaminoglycan (GAG) medium release/scaffold content, collagen 1, 2, aggrecan, Sox9 mRNA, histology and ELISA for BMP-2-transgene expression. Values given are normalized to G1 at d21.

Results: Wet weight/DNA-content were highest in G4/G2, while DNA-content declined over time. GAG release/scaffold content and GAG per DNA increased over time and was highest in G4/G3 (p<0.05). Collagen 1 was lowest in G1/G4, collagen 2 was highest in G4/G2 (<0.05), aggrecan was highest in G3/G2 (<0.05), while Sox5 was highest in G4/G3 (p<0.05). Only collagen 2 aggrecan showed significant increases in all groups over time. Cumulation was highest in G4. Histology revealed highest cell density in G4/G2. BMP-2-transgene expression was stable through d35.

Conclusions: When compared to control, in-vitro chondrogenesis is most efficient when simultaneous stimulation with dynamic compression and shear, combined with BMP-2, is applied.

The mechanical properties of the articular cartilage in second-look after mosaicplasty

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Purpose: We developed an ultrasonic measurement system to detect cartilage stiffness, surface roughness and thickness. The objective of this study was to evaluate the mechanical properties of the grafted cartilage (P), surrounding normal-like cartilage (N), the gap (G) and the donor (D) in second-look after mosaicplasty using our ultrasonic device.

Methods and Materials: There were 22 patients 24 knees who had second-look arthroscopy after mosaicplasty, and we received their informed consent about this study. They were 8 men 14 women, 8 right knees 16 left ones. Their mean operative age in second-look was 47.4 year-old. The mean period from mosaicplasty to second-look was 17.1 months. The number of measured areas was 73 in P, 54 in G and 42 in D. The ratio of the mechanical properties in P, G and D to the ones in N was calculated.

Results: In stiffness, P (206.2%) was significantly larger than G (49.3%) and D (65.4%). In surface roughness, P (93.2%) was significantly smaller than G (313.8%) and D (307.9%). In thickness, there was no significant difference in the mechanical properties of P, G and D. The ratio of the mechanical properties of P, G and D to the ones in N was calculated.

Conclusions: When compared to control, in-vitro chondrogenesis is most efficient when simultaneous stimulation with dynamic compression and shear, combined with BMP-2, is applied.