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# Systematic Review and Meta-Analysis of the Clinical Evidence on the Use of Autologous Matrix-Induced Chondrogenesis (AMIC®) in the Knee

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The first meta-analysis of a one-step cartilage repair procedure in the knee using the Chondro-Gide® membrane demonstrates significant improvement in pain and functional scores compared to pre-operative values during a follow-up of longer than 3 years.

## Systematic Literature Search

66 publications were identified in a systematic search performed in the PubMed & Embase databases as well as in other sources by use of the search terms: "Chondro-Gide®", "AMIC®", "cartilage", and "knee".



54 publications were excluded because, among other reasons, the following inclusion criteria were not fulfilled: clinical study with a minimum of 6 patients, cartilage defects in the knee, and primary endpoints of pain and function. None of the excluded studies reported adverse events related to the AMIC® procedure.



### 12 publications were included:

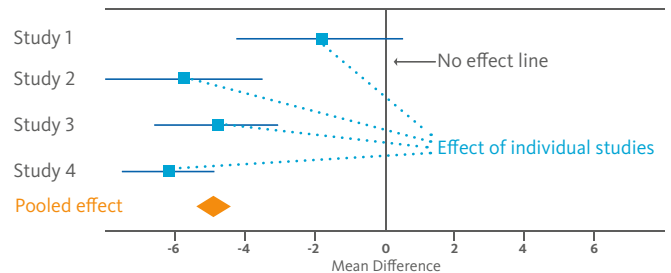
- > 375 patients with a minimum follow-up of 2 years
- > Mean age: 36.2 years (14-70 years)
- > with chondral and osteochondral defects Outer-bridge Grade III & IV
- > Mean defect size: 4.2 cm<sup>2</sup> (0.8-22 cm<sup>2</sup>)

## Statistical Methods

- > Meta-analysis based on reported pain VAS, Lysholm, and IKDC scores.
- > The random-effects model was used for statistical analysis using an estimator as a measure of the heterogeneity between the different studies.
- > Results were displayed using Forest plots, which demonstrate the heterogeneity and effect size of the individual studies as well as the pooled effect (see graph on the right).
- > The vertical line through 0 indicates no effect: a big distance of the individual effect to this line and a narrow confidence interval indicate a significant treatment effect and conclusive data.

## Forest Plot

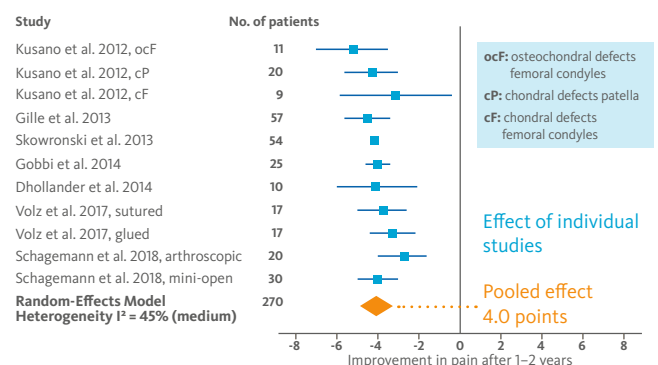
Effect size with 95% confidence interval (—)



## Significant and Clinically Relevant Improvement in Pain

- > The forest plots on the right indicate a significant improvement of 4.0 points for pain VAS from baseline to follow-up at years 1–2 (see upper graph) and an even bigger improvement of 4.8 points after a follow-up of >3 years (see lower graph).
- > This reduction in pain VAS of more than 4 points (on a scale from 0-10) corresponds to a clinically important difference.

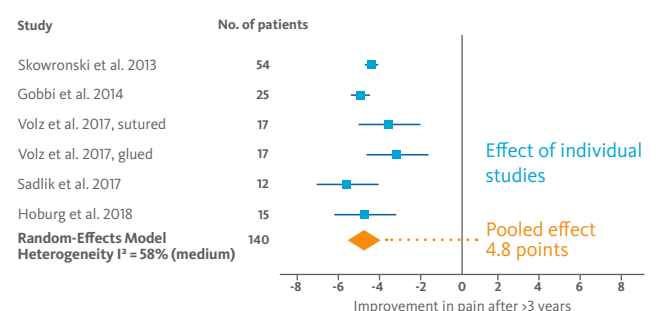
## Forest Plot for Pain VAS after 1–2 Years



## Functional Improvement (no graph shown)

- > The random effects model shows significant improvement for the Lysholm score (by 34.7 points) and IKDC score (by 32.6 points) from baseline to follow-up at years 1–2.
- > At follow-up >3 years, the improvement of the IKDC score was even bigger (44.9 points) while the improvement of the Lysholm score remained constant (35.1).

## Forest Plot for Pain VAS after >3 Years



## CHONDRO-GIDE® LITERATURE HIGHLIGHT

The bilayer collagen membrane is an established product for cartilage therapies with 20 years of clinical use. AMIC® Chondro-Gide®, a technique that combines bone marrow stimulation with the use of a collagen membrane, has been used for over 15 years. Based on pre-clinical and clinical evidence, AMIC® was included in the treatment recommendations for cartilage lesions of the talus, knee and hip by the respective committees of the German Society for Orthopaedics and Trauma (DGOU).

This literature highlight addresses important aspects of the evidence for Chondro-Gide® and AMIC®.

## Conclusions

- > The meta-analysis documents that the AMIC® Chondro-Gide® procedure significantly improves pain and function in knee joints with chondral and osteochondral lesions.
- > The improvement was **maintained over more than 5 years** which confirms the long-term success of AMIC® Chondro-Gide® in Outerbridge grade III & IV lesions with an average size of 4.2 cm<sup>2</sup>.
- > A conversion to arthroplasty was required in less than 1% (3/375) of the cases. Treatment-related adverse events were not reported, which confirms the **excellent safety profile of the AMIC® procedure**.
- > This meta-analysis demonstrates that use of the Chondro-Gide® membrane for coverage of cartilage defects resulted in a significant and durable improvement of clinical outcomes for lesions with an average size of 4.2 cm<sup>2</sup>, which is clearly above the size limit for microfracturing.
- > Based on the results of this meta-analysis, the authors recommend **AMIC® Chondro-Gide® as the preferred treatment method for knee joints with grade III & IV chondral and osteochondral lesions >2–3 cm<sup>2</sup>**.

For details of the study refer to the original article:

Original Article

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- > Chondro-Gide®, the original AMIC® membrane<sup>1</sup>
- > One-step procedure for cartilage regeneration techniques<sup>1,2,3</sup>
- > With more than 10 years of clinical experience<sup>4</sup>



- 1 Geistlich Pharma AG, data on file
- 2 Schiavone Panni, A. et al. Good clinical results with autologous matrix-induced chondrogenesis (Amic) technique in large knee chondral defects. *Knee Surg Sports Traumatol* 2018 Apr;26(4):1130-1136. doi: 10.1007/s00167-017-4503-0. (Clinical study)
- 3 Niemeyer, P. et al. Significance of Matrix-augmented Bone Marrow Stimulation for Treatment of Cartilage Defects of the Knee: A Consensus Statement of the DGOU Working Group on Tissue Regeneration. *Z Orthop Unfall* 2018; 156(05): 513-532. doi: 10.1055/a-0591-6457
- 4 Kaiser, N., et al. Clinical results 10 years after AMIC in the knee. *Swiss Med Wkly*, 2015, 145 (Suppl 210), 43S. (Clinical study)