

SpheChon

10 - 70 spheroids/cm² implantation suspension

1. TRADENAME

SpheChon 10-70 spheroids/cm² implantation suspension

2. QUALITATIVE AND QUANTITATIVE COMPOSITION

2.1 General description

Spheroids of human autologous matrix-associated chondrocytes for implantation suspended in isotonic sodium chloride solution.

2.2 Qualitative and quantitative composition

Spheroids are spherical aggregates of *ex vivo* expanded human autologous chondrocytes and self-synthesized extracellular matrix.

Each pre-filled syringe or applicator contains a specific number of spheroids according to the defect size (10-70 spheroids/cm²) to be treated.

For the full list of excipients, see section 6.1.

3. PHARMACEUTICAL FORM

Implantation suspension.

White to yellowish spheroids of matrix-associated autologous chondrocytes in a clear, colourless solution.

4. CLINICAL PARTICULARS

4.1 Therapeutic indications

Repair of symptomatic articular cartilage defects of the femoral condyle and the patella of the knee (International Cartilage Regeneration & Joint Preservation Society [ICRS] grade III or IV) with defect sizes 1 cm² to 10 cm² in adults and adolescents with closed epiphyseal growth plate in the affected joint.

4.2 Posology and method of administration

SpheChon is intended for autologous use only. It must be administered by a specialised orthopedic surgeon and in a medical facility.

Posology

10-70 spheroids are applied per square centimetre defect.

Elderly

The safety and efficacy of SpheChon in patients aged over 50 years have not been established. No data are available.

Paediatric population

The safety and efficacy of SpheChon in children and adolescents with still open epiphyseal growth plate in the affected joint have not been established. No data are available.

Method of administration

For intraarticular use.

SpheChon is administered to patients by intraarticular implantation.

The treatment with SpheChon is a two-step procedure.

In a first step, a biopsy must be performed during a surgical procedure (preferably an arthroscopy or mini-arthrotomy). During arthroscopy or arthrotomy the defect and defect size of the cartilage should be determined as accurately as possible. After biopsy, the cartilage cells will be cultured at the manufacturing site until they will form spheroids that constitute SpheChon. The process takes about 6 to 8 weeks.

In a second step, the implantation must be performed during a surgical procedure (preferably an arthroscopy or mini-arthrotomy). A debridement of the defect area is required. The subchondral plate should not be damaged. The spheroids are provided in a pre-filled syringe or an applicator (stem length 150 mm (co.fix 150)). Spheroids should be applied evenly on the defect ground and, if necessary, spread over the whole defect area by means of surgical instruments. The spheroids self-adhere within 20 minutes onto the defect ground. Afterwards, the surgical wound can be closed without any additional cover of the treated area (e.g. periosteal flap; matrix), or any fixation of spheroids by using fibrin glue. The treatment of defect sizes 1 cm² to 10 cm² is eligible for single as well as adjacent defects (combined area).

Patients treated with SpheChon have to undergo a specific rehabilitation program (see section 4.4). The program may take up to one year depending on the recommendation of the physician.

For information on preparation and handling of SpheChon, please refer to section 6.6.

4.3 Contraindications

- Patients with not fully closed epiphyseal growth plate in the affected joint.
- Primary (generalised) osteoarthritis.
- Advanced osteoarthritis of the affected joint (exceeding grade II according to Kellgren and Lawrence).
- Infection with the hepatitis B virus (HBV), hepatitis C virus (HCV) or HIV I/II.

4.4 Special warnings and precautions for use

Traceability

The traceability requirements of cell-based advanced therapy medicinal products must apply. To ensure traceability the name of the product, the batch number and the name of the treated patient should be kept for a period of 30 years after expiry date of the product.

Autologous use

SpheChon is intended solely for autologous medicinal use and should under no circumstances be given to any other patient than the donor. SpheChon must not be administered if the information on the product labels and shipping documents do not match the patient's identity. The order number (lot number) on the primary package should also be checked prior to administration.

General

SpheChon must not be applied if the primary or secondary packaging is damaged and therefore unsterile.

The application of SpheChon in patients with cartilage defects outside the knee joint is not recommended. The safety and efficacy of SpheChon in patients with cartilage defects outside the femoral condyle and the patella of the knee have not been established. No data are available.

Precautions for use

Treatment of patients with local inflammations, or acute, as well as recent bone or joint infections, should be temporarily deferred until the recovery from the infection is documented.

In the pivotal studies of SpheChon, patients were excluded if they had signs of chronic inflammatory diseases.

Concomitant joint problems such as early osteoarthritis, subchondral bone defects, instability of the joint, lesions of ligaments or of the meniscus, abnormal weight distribution in the joint, varus or valgus malalignment, patellar malalignment or instability, and metabolic, inflammatory, immunological or neoplastic diseases of the affected joint are potential complicating factors. Untreated bone oedema corresponding with the cartilage defect to be treated may adversely affect the success of the procedure. If possible, concomitant joint problems should be corrected prior to or at the latest at the time of SpheChon implantation.

For a decision on treatment of facing defects ("kissing lesions" larger than ICRS grade II) the degree of overlap and location of the defects in the joint have to be taken into consideration.

Post-operative haemarthrosis occurs mainly in patients with a predisposition to haemorrhage or poor surgical haemorrhage control. The haemostatic functions of the patient should be screened prior to surgery. Thromboprophylaxis should be administered according to local guidelines.

Application of SpheChon in obese patients is not recommended.

Rehabilitation

After implantation, the patient should follow an appropriate rehabilitation schedule. Physical activity should be resumed as recommended by the physician. Too early and vigorous activity may compromise the grafting and the durability of clinical benefit from SpheChon.

Compliance with an adequate rehabilitation programme after implantation (especially for patients with mental disorders or addiction) is required.

Cases in which SpheChon cannot be supplied

If the manufacturing of spheroids has failed or if the release criteria are not fulfilled, e.g. due to insufficient biopsy quality, the medicinal product cannot be delivered. The physician will be informed immediately.

4.5 Interaction with other medicinal products and other forms of interaction

No interaction studies have been performed.

Locally applied antibiotics or disinfectants may have potential toxicity on articular cartilage and it is not recommended that SpheChon comes into direct contact with those substances.

In the pivotal studies of SpheChon, patients were excluded if they were under medical treatment with corticosteroids.

4.6 Fertility, pregnancy and lactation

Pregnancy

No clinical data on exposed pregnancies are available for autologous chondrocytes or spheroids from autologous chondrocytes.

As SpheChon is used to repair cartilage defects of the joint and is therefore implanted during a surgical procedure, it is not recommended for use in pregnant women.

Breastfeeding

As SpheChon is used to repair cartilage defects of the joint and is therefore implanted during a surgical procedure, it is not recommended for use in breast-feeding women.

Fertility

There are no data on possible effects of SpheChon treatment on fertility.

4.7 Effects on ability to drive and use machines

The surgical procedure (i.e. the biopsy or implantation of SpheChon) will have a major influence on the ability to drive and use machines. During the rehabilitation period, the ability to drive and use machines may also be restricted due to reduced mobility. Therefore, patients should consult their treating physician and strictly follow their advice.

4.8 Undesirable effects

Summary of safety profile

Information on adverse reactions from clinical trials and a non-interventional study in adolescents as well as from post-marketing experience are available. During treatment with SpheChon surgery-related (implantation) or SpheChon-related adverse reactions may occur.

Tabulated list of adverse reactions

The adverse reactions related to SpheChon are displayed by system organ class and frequency in Table 1 below: very common ($\geq 1/10$); common ($\geq 1/100$ to $< 1/10$); uncommon ($\geq 1/1,000$ to $< 1/100$); rare ($\geq 1/10,000$ to $< 1/1,000$); very rare ($< 1/10,000$); and not known (cannot be estimated from the available data). Within each frequency grouping, undesirable effects are presented in order of decreasing seriousness.

Table 1: Undesirable Effects related to SpheChon

System Organ Class (SOC)	Frequency	Adverse Reaction
Infections and infestations	Rare	Cellulitis Osteomyelitis
Immune system disorders	Rare	Hypersensitivity
Musculoskeletal and connective tissue disorders	Common	Bone marrow oedema Joint effusion Arthralgia Joint swelling
	Uncommon	Chondromalacia Joint noise Joint lock Synovial cyst Chondropathy Synovitis Loose body in the joint
	Rare	Osteochondrosis Osteonecrosis Osteophyte formation Arthritis infective
	Not known	Arthrofibrosis
General disorders and administration site conditions	Common	Pain
	Uncommon	Gait disturbance
Injury, poisoning and procedural complications	Uncommon	Hypertrophy Graft loss
	Rare	Graft delamination Implant site infection Infrapatellar fat pad inflammation

Description of selected adverse reactions

Graft delamination

Graft delamination describes the partial or complete detachment of the formed tissue from the subchondral bone and the surrounding cartilage. A complete graft delamination is a serious complication which can be accompanied by pain. Risk factors are, in particular, non-treatment of concomitant diseases, such as joint instability or lack of compliance with the rehabilitation protocol.

Hypertrophy

A symptomatic implant site hypertrophy may occur during treatment with SpheChon resulting in pain.

Adverse reactions related to the surgical procedure:

The following adverse reactions considered surgery-related have been reported during the course of the clinical trials and/or from spontaneous sources:

- SOC Infections and infestations: pneumonia (not known)

- SOC Vascular disorders: lymphoedema (uncommon), thrombophlebitis (rare), deep vein thrombosis (uncommon), haematoma (rare)
- SOC Respiratory, thoracic and mediastinal disorders: pulmonary embolism (uncommon)
- SOC Skin and subcutaneous tissue disorders: scar pain (uncommon)
- SOC Musculoskeletal and connective tissue disorders: joint effusion (common), arthralgia (common), joint swelling (common), tendonitis (uncommon), muscular weakness (uncommon), patellofemoral pain syndrome (uncommon), osteonecrosis (rare), synovitis (uncommon), loose body in the joint (uncommon)
- SOC General disorders and administration site conditions: pain (common), gait disturbance (uncommon), discomfort (very rare)
- SOC Injury, poisoning and procedural complications: ligament sprain (uncommon), suture-related complication (rare), wound dehiscence (rare)

The recorded product- and surgery-related adverse reactions were in most cases not serious.

Paediatric population

In general, the adverse reactions in paediatric patients were similar in frequency and type to those seen in adult patients.

4.9 Overdose

In cases where the recommended dose was significantly exceeded (up to 170 spheroids/cm² in an investigator-initiated trial with a follow-up period of 12 months), no negative effects were observed.

5. PHARMACOLOGICAL PROPERTIES

5.1 Pharmacodynamic properties

Pharmacotherapeutic group: Other drugs for disorders of the musculo-skeletal system, ATC code: M09AX02

Mechanism of action

Autologous chondrocyte implantation (ACI) is based on the extraction of the patient's own chondrocytes isolated from healthy cartilage, their culture *in vitro* and their subsequent implantation into the cartilage defect. SpheChon is cultured and implanted as three-dimensional spheroids.

Clinical efficacy

SpheChon has been analysed in a prospective, randomized, uncontrolled open-label, multicentre Phase II clinical trial including 75 patients with focal cartilage defects (ICRS grade III or IV) in the knee with a defect size of 4-10 cm². Twenty-five patients were treated with 10-30 spheroids/cm² defect, 25 with 40-70 spheroids/cm² defect and 25 with 3-7 spheroids/cm² defect. The intention-to-treat (ITT) population consisted of 73 patients. The mean patient age was 34 years (range 19 to 48 years) with a mean body mass index (BMI) of 25.2. In all three dose groups a significant improvement ($\alpha < 0.05$) of the KOOS (Knee Injury and Osteoarthritis Outcome Score) after 12, 24, 36, 48 and 60 months compared to before treatment could be observed. For 'all dose groups' the mean overall KOOS increased in the first year after treatment from 57.0 ± 15.2 to 73.4 ± 17.3 on a scale from 0 (worst) to 100 (best) and continued to increase slightly, reaching 74.6 ± 17.6 after 18 months, 73.8 ± 18.4 after two years, 77.0 ± 17.8 after three years, 77.1 ± 18.6 after four years and 76.9 ± 19.3 at final follow-up after five years. Changes within each dose group were of similar magnitude, and the three between-group (pairwise) analyses did not reveal any statistically significant differences between the groups.

Further patient scores, e.g. the International Knee Documentation Committee (IKDC; subjective evaluation of the knee) and the Lysholm score showed after 12, 24, 36, 48 and 60 months also a significant improvement in comparison to the value before treatment.

Magnetic resonance imaging (MRI) results according to the Magnetic Resonance Observation of Cartilage Repair Tissue (MOCART) scoring system (0 = worst result; 100 = best result) showed an improvement within the first 60 months from 59.8 at Visit 2 (3 months after treatment) up to 75.0 points in the group of patients treated with 3-7 spheroids/cm² defect, from 64.5 at Visit 2 up to 76.4 points in the dose group of 10-30 spheroids/cm² defect, and from 64.7 at Visit 2 up to 73.6 points in the dose group of 40-70 spheroids/cm² defect.

Furthermore, a multicentre, prospective, randomised, controlled Phase III clinical trial was conducted. The objective of the study was to compare the efficacy and safety of the treatment of cartilage defects (1 to less than 4 cm²) at the femoral condyle of the knee joint with SpheChon and microfracture treatment over a period of 5 years. Pivotal efficacy data were based on an interim analysis at 12 months after treatment. Additional statistical assessments were performed 24, 36, 48 and 60 months after treatment.

The treatment groups were balanced with respect to size, demography and disease background. The analysis population comprised 102 patients (41 women, 61 men) aged 37 years on average (range from 18 to 49 years) with a mean body mass index (BMI) of 25.8. Defect sizes ranged from 0.5 to 4 cm². ICRS grades were mostly IV A, followed by IIIB and IIIA (56, 22 and 10 patients respectively). None of the patients had received prior treatment with microfracture for their lesion less than one year before screening.

The assessment of the 'overall KOOS' for the ITT population showed that both treatments yielded a statistically significant improvement relative to baseline (day before arthroscopy). For the patients treated with SpheChon the mean overall KOOS (scale of 0-100 ± SD) increased from 56.6 ± 15.4 at baseline to 81.5 ± 17.3 at 24 months after treatment. For patients treated by microfracture the mean overall KOOS increased from 51.7 ± 16.5 to 73.2 ± 18.8 after 24 months ($p < 0.0001$ for both treatment groups). With regard to the between-group analysis, the treatment with SpheChon passed the test of non-inferiority compared with microfracture (Δ of 6.1 with lower bound of CI equal to -0.4 at the 24 months assessment).

The results at later time points were consistent with these findings. At 60 months follow-up, overall KOOS was 84.5 ± 16.1 after treatment with SpheChon as compared to 75.4 ± 19.6 after microfracture. The total MOCART scores 3, 12, 18, 24 until 60 months after treatment did not differ significantly between the two treatment groups.

IKDC subscores as well as results from the IKDC Current Health Assessment Form and the modified Lysholm score also revealed overall improvements from baseline in both treatment groups with numerically slightly better results in the SpheChon group but with no statistical significance.

Paediatric population

SpheChon has been analysed in a non-interventional, open-label, multicentre surveillance study in 60 adolescent patients with closed epiphysial growth plates, aged 15 to < 18 years with focal cartilage defects (ICRS grade 3 or 4) in the knee with a defect size of 0.75 – 12.00 cm². The mean patient age was 16.5 years (range 15 to 17 years) with a mean body mass index (BMI) of 23.9. Mean (SD) follow-up time, defined as the interval between the date of implantation and date of the follow-up visit as documented by the physician was 48.4 (19.5) months. The mean (SD) overall KOOS score in the paediatric population at follow-up was 75.5 (18.2). MRI results according to the MOCART scoring system (0 = worst result; 100 = best result) at follow-up was mean (SD) 74.9 (18.5) and ranged from a minimum of 30 to a maximum of 100.

5.2 Pharmacokinetic properties

Due to the nature and intended clinical use of SpheChon, conventional studies on pharmacokinetics, absorption, distribution, metabolism, and elimination are not applicable.

5.3 Preclinical safety data

Ex vivo produced spheroids were implanted in mice (subcutaneous implantation of cartilage explants with human spheroids) or in minipigs (autologous spheroids implanted in cartilage defects). No signs of inflammation, synovitis, infections, rejection, hypertrophy or immune toxicity, tumourigenicity or biodistribution were observed.

A GLP-compliant examination of biodistribution and tumourigenicity in NSG mice showed no signs of biodistribution and/or migration from implanted human spheroids. No suspicion of potential tumourigenesis or increased prevalence of tumours due to the implanted spheroids was observed. In a sheep study, also no biodistribution was observed after injection of spheroids into the knee joint. This suggests that there are no risks for the use of spheroids in humans.

6. PHARMACEUTICAL PARTICULARS

6.1 List of excipients

Sodium chloride

6.2 Incompatibilities

In absence of compatibility studies, this medicinal product should not be mixed with other medicinal products.

6.3 Shelf life

72 hours

6.4 Special precautions for storage

Store at temperatures between 1 °C and 10 °C.

Do not freeze.

Do not irradiate.

Do not open the outer packaging before use to prevent microbial contamination.

6.5 Nature and contents of container and special equipment for use, administration or implantation

The spheroids are provided in an applicator or a pre-filled syringe as primary packaging unit.

The applicator (stem length 150 mm (co.fix 150)) is packed in a sterile tube and additionally surrounded by an extra pouch. A tube may contain a maximum of two co.fix 150. The catheter of the applicator is made of thermoplastic polyurethane, the sealing plug on one side of acrylonitrile butadiene styrene and a silicone stopper on the other side. The applicator is delivered with an application device (sterile injection syringe).

The pre-filled syringe consists of a luer lock, a sealing ring and a cover cap. It is packed in a sterile tube with a screw-type cap and additionally surrounded by an extra pouch. All parts of the pre-filled syringe are made of polypropylene, the sealing ring of isoprene. Silicone oil serves as lubricant. The pre-filled syringe is delivered with an application device (indwelling cannula or filter stem).

Pack sizes

The number of primary packaging units delivered depends on the type of the primary packaging unit and the number of spheroids necessary for the specific defect size (10-70 spheroids/cm²).

One applicator has a maximum capacity of 60 spheroids in a volume of up to 200 microlitre isotonic sodium chloride solution.

One pre-filled syringe has a maximum capacity of 100 spheroids in a volume of up to 1000 microlitre isotonic sodium chloride solution.

6.6 Special precautions for disposal and other handling

Precautions to be taken before handling or administering the medicinal product:

If the primary or secondary packaging is damaged and therefore unsterile, SpheChon should not be applied.

Remaining spheroids must not be stored for later application.

Unused medicinal product and all material that has been in contact with SpheChon (solid and liquid waste) should be handled and disposed of as potentially infectious waste in accordance with local guidelines on handling of human-derived material.

7. NAME AND ADDRESS OF MANUFACTURER(S)

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8. PRODUCT OWNER

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9. DATE OF REVISION OF THE TEXT

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