

**ANNEX I**  
**SUMMARY OF PRODUCT CHARACTERISTICS**

▼ This medicinal product is subject to additional monitoring. This will allow quick identification of new safety information. Healthcare professionals are asked to report any suspected adverse reactions. See section 4.8 for how to report adverse reactions.

## **1. NAME OF THE MEDICINAL PRODUCT**

Holoclar 79,000 - 316,000 cells/cm<sup>2</sup> living tissue equivalent

## **2. QUALITATIVE AND QUANTITATIVE COMPOSITION**

### **2.1 General description**

*Ex vivo* expanded autologous human corneal epithelial cells containing stem cells.

### **2.2 Qualitative and quantitative composition**

Holoclar consists of a transparent circular sheet of 300,000 to 1,200,000 viable autologous human corneal epithelial cells (79,000 - 316,000 cells/cm<sup>2</sup>), including on average 3.5 % (0.4 to 16 %) limbal stem cells, and stem cell-derived transient amplifying and terminally differentiated cells, attached on a supportive 2.2 cm diameter fibrin layer and maintained in the transport medium.

For the full list of excipients, see section 6.1.

## **3. PHARMACEUTICAL FORM**

Living tissue equivalent.

Transparent, circular sheet.

## **4. CLINICAL PARTICULARS**

### **4.1 Therapeutic indications**

Treatment of adult patients with moderate to severe limbal stem cell deficiency (defined by the presence of superficial corneal neovascularisation in at least two corneal quadrants, with central corneal involvement, and severely impaired visual acuity), unilateral or bilateral, due to physical or chemical ocular burns. A minimum of 1 - 2 mm<sup>2</sup> of undamaged limbus is required for biopsy.

### **4.2 Posology and method of administration**

Holoclar must be administered by an appropriately trained and qualified surgeon and is restricted to hospital use only.

#### Posology

This medicinal product is intended for autologous use only.

The amount of cells to be administered is dependent on the size (surface in cm<sup>2</sup>) of the corneal surface. Each preparation of Holoclar contains an individual treatment dose with sufficient number of cells to cover the entire corneal surface. The recommended dose of Holoclar is 79,000 - 316,000 cells/cm<sup>2</sup>, corresponding to 1 cm<sup>2</sup> of product/cm<sup>2</sup> of defect. Each preparation of Holoclar is intended as a single treatment. The treatment may be repeated if considered indicated by the treating physician.

The administration should be followed by an appropriate antibiotic and anti-inflammatory treatment schedule, as recommended by the physician (see section 4.4).

### Special populations

#### *Elderly*

Data on the use of Holoclar in elderly populations are limited. No recommendation on posology can be made (see sections 4.8 and 5.1).

#### *Hepatic and renal impairment*

Data on the use of Holoclar in patients with hepatic and renal impairment are not available.

#### *Paediatric population*

Data regarding the safety and efficacy of Holoclar in children and adolescents aged 0 to 18 years is limited. Currently available data are described in section 4.8 and 5.1, but no recommendation on posology can be made.

### Method of administration

For implantation.

Before administration, it must be confirmed that the patient's identity matches the unique patient information on the Holoclar label and accompanying documentation.

Full technical details on the procedures associated with the use of Holoclar are provided in the educational manual.

#### *Biopsy*

For the manufacture of Holoclar, a biopsy of 1 – 2 mm<sup>2</sup> of undamaged limbus is required. The biopsy is performed using topical anaesthesia. The eye is subjected to ocular surface lavage with sterile balanced salt solution for eye irrigation followed by detachment of the conjunctiva from the limbus to expose the sample collection site of the cornea. An incision of 2 x 2 mm is made to remove the biopsy. The biopsy is placed in the sterile test tube supplied containing transport medium. The biopsy must be received by the manufacturer within 24 hours from the procurement.

### Post-biopsy treatment

Following the biopsy, an appropriate regimen of prophylaxis with an antibiotic treatment must be given.

In some cases, it may be possible that the source limbal stem cells of the patient are not expandable or that the release criteria are not met, due to poor biopsy quality, patient characteristics, or manufacturing failure. Therefore, it can occur that Holoclar cannot be delivered. The surgeon will be informed as early in the process as possible and should hence select an alternative treatment for the patient.

#### *Implantation*

Holoclar is intended solely for use in autologous limbal stem cell regeneration in line with the approved therapeutic indication and should be administered under aseptic conditions in conjunction with limbal peritomy, undermining of the conjunctiva and excision of the corneal fibrovascular tissue in preparation of the defect bed. Next, the cultured tissue is fitted under the undermined conjunctiva. The excess of insert is trimmed, and the edge covered with the conjunctiva applying 2 or 3 stitches (sutures) of vicryl or silk 8/0 in order to form a physical seal of the lesion and to secure the implant. The eyelids are kept closed over the insert with a steri-strip band.

Holoclar is generally implanted under topical retrobulbar or parabolbar anaesthesia. Other anaesthesiology procedures may be followed at the discretion of the surgeon, excluding the use of lidocaine local anaesthesia or anaesthetics containing adrenaline.

### Post-operative treatment

Following implantation, an appropriate regimen of topical and systemic anti-inflammatory and prophylactic antibiotic treatment must be given.

The following regimen is suggested: doxycycline 100 mg tablets twice daily (or amoxicillin 500 mg twice daily) and prednisone orally at a daily dose of 0.5 mg / kg (to a maximum dose of 25 mg) per day should be administered from the day of surgery for 2 weeks. After 2 weeks the systemic antibiotic administration should be stopped and the daily dose of prednisone should be tapered to 0.25 mg / kg (maximum 12.5 mg) per day for 1 week, to 0.125 mg / kg (maximum 5.0 mg) per day for the following week and then stopped.

Two weeks after surgery, a topical corticosteroid treatment should be started with preservative-free dexamethasone 0.1 % eye-drops, 1 drop three times per day for 2 weeks, then reduced to 1 drop twice daily for 1 week and 1 drop once daily for a further week. The topical corticosteroid can be maintained in case of persistent ocular inflammation.

The implantation must be followed by an appropriate monitoring schedule.

For detailed instructions on preparation, measures to take in case of accidental exposure and disposal of Holoclar, see section 6.6.

### **4.3 Contraindications**

Hypersensitivity to any of the excipients listed in section 6.1 or to bovine serum and murine 3T3-J2 cells.

### **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

Holoclar is intended solely for autologous use and must not, under any circumstances, be administered to other patients. Holoclar must not be administered if the information on the product labels and lot number do not match the patient's identity.

#### Hypersensitivity reactions

Holoclar contains lethally-irradiated murine 3T3 fibroblast cells and may contain traces of foetal bovine serum. Patients with a known hypersensitivity to mice or foetal bovine serum must not be treated (see section 4.3).

#### Transmission of an infectious agent

Holoclar could contain potentially infected biological material. Although Holoclar is tested for sterility and mycoplasma, a risk of transmission of infectious agents exists. Healthcare professionals administering Holoclar must, therefore, monitor patients for signs and symptoms of infections after treatment and treat appropriately, if needed.

#### Precautions for use

A thorough evaluation of the patient should be done taking into consideration not only the clinical need of the candidate, but also the biological and pathophysiological alterations in the wound bed environment, to define the timing of any procedure and allow the proper engraftment and growth of the stem cells of the living tissue that constitute Holoclar. Concomitant surgeries should be excluded and anticipated or deferred to Holoclar implantation.

Concomitant eyelids malposition, conjunctival scarring with fornix shortening, corneal anaesthesia and/or conjunctival anaesthesia or severe hypoaesthesia, pterygium and severe dry eye are potential complicating factors. Concomitant eye problems should be corrected prior to Holoclar implantation.

At any of the steps of the treatment with Holoclar, topical lidocaine or anaesthetics containing adrenaline must be avoided.

Patients with acute ocular inflammation or infections should be deferred until recovery has been documented since inflammation may compromise treatment success.

Concomitant use of Holoclar with eye-drops containing benzalkonium chloride, and/or other preservatives is not recommended (see section 4.5).

The procedure of Holoclar administration includes the use of antibiotics and corticosteroids (see section 4.2). For relevant safety information, physicians should consult the SmPC of these medicinal products.

#### **4.5 Interaction with other medicinal products and other forms of interaction**

No interaction studies have been performed.

The concomitant use of topical lidocaine or anaesthetics containing adrenaline must be avoided as they reduce the colony forming efficiency.

Eye-drops containing benzalkonium chloride, and/or other preservatives, must be avoided. Benzalkonium chloride (as well as other quaternary ammonium compounds) is cytotoxic and eye-drops containing this preservative may damage the corneal epithelium, in particular the proliferative basal layer, exposed during the implantation procedure. Other cytotoxic agents must be avoided.

No interactions between Holoclar and the post-biopsy/post-operative treatment suggested in section 4.2 have been reported.

#### **4.6 Fertility, pregnancy and lactation**

##### Pregnancy

There are no data for the use of Holoclar in pregnant women.

Animal studies are not available with respect to reproductive toxicity (see section 5.3).

As a precautionary measure, and in light of the requirement of the post-operative pharmacological treatment, it is preferable to avoid the use of Holoclar during pregnancy.

##### Breast-feeding

As a precautionary measure, Holoclar is not recommended for implant during breast-feeding.

##### Fertility

No clinical data on the effects of Holoclar on fertility are available.

#### **4.7 Effects on ability to drive and use machines**

Holoclar has a major influence on the ability to drive and use machines due to the surgical nature of the underlying procedure for the implantation. Therefore, following treatment with Holoclar, driving and using machines must be deferred and patients should follow the advice of their treating physician.

#### **4.8 Undesirable effects**

### Summary of the safety profile

The most serious adverse reactions are corneal perforation and ulcerative keratitis, which may occur within the 3 months from Holoclar implantation and are related to the poor corneal stem cell engraftment, and syncope vasovagal occurring in the first day after surgery due to eye pain. The most common adverse reactions are eye disorders. The most frequently occurring reactions related to the surgical procedure were eye pain (4.0 %), corneal epithelium defect (3.4 %) and conjunctival haemorrhage (2.2 %), the latter appearing mostly during the first day after surgery and in most cases to be mild in intensity and disappearing within a few days without treatment.

### Tabulated list of adverse reactions

Adverse reactions reported in patients implanted with Holoclar in clinical studies and post-marketing experience are provided in the table.

The following categories are used to rank the adverse reactions by frequency of occurrence: 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 the adverse reactions are presented in the order of decreasing seriousness.

<b>MedDRA System organ class</b>	<b>Adverse reaction</b>	<b>Frequency</b>
Infections and infestations	Corneal infection, conjunctivitis	Uncommon
Nervous system disorders	Syncope vasovagal, headache	Uncommon
Eye disorders	Conjunctival haemorrhage, eye haemorrhage, corneal epithelium defect, corneal abrasion/erosion, glaucoma/intraocular pressure increased, keratitis/ulcerative keratitis, blepharitis, eye pain	Common
	Conjunctival adhesion, conjunctival granuloma, conjunctival hyperaemia, corneal oedema, corneal perforation, corneal thinning, corneal opacity, corneal hypertrophy, eye inflammation, hyphaemia, eye irritation, photophobia, entropion, trichiasis, mydriasis, lacrimation increased	Uncommon
Gastrointestinal disorders	Nausea	Uncommon
Skin and subcutaneous tissue disorders	Haemorrhage subcutaneous, dermatitis allergic	Uncommon
General disorders and administration site conditions	Metaplasia of the implant, implant site extravasation, sensation of foreign body	Uncommon
Injury, poisoning and procedural complications	Eye operation complication	Common
	Engraft failure, suture rupture, persistent corneal epithelial defect, procedural vomiting	Uncommon

### Description of selected adverse reactions

Eye pain (4.0 %) and corneal epithelium defect (3.4 %) were the most common individual adverse reactions not related to the surgical procedure. Glaucoma (1.9 %) was the most frequent adverse reaction considered related to the corticosteroid treatment (see sections 4.2 and 4.4). Reports of glaucoma included adverse reactions of intraocular pressure.

### Paediatric population

There is no information on the safety of Holoclar in children up to 5 years of age and only limited information in patients 6 - 17 years of age. In the paediatric patients included in the studies HLSTM01

(age 13, 14 and 16 years), HLSTM02 (age 8 and 14 years) and HOLOCORE (6 to 13 years) the profile of adverse reactions was not different from the adult population.

#### Elderly

There is only limited information in elderly (n=16, > 65 years old) and very elderly (n= 4, 75-84 years old) patients.

#### Reporting of suspected adverse reactions

Reporting suspected adverse reactions after authorisation of the medicinal product is important. It allows continued monitoring of the benefit/risk balance of the medicinal product. Healthcare professionals are asked to report any suspected adverse reactions via the national reporting system listed in Appendix V.

### **4.9 Overdose**

No case of overdose has been reported.

## **5. PHARMACOLOGICAL PROPERTIES**

### **5.1 Pharmacodynamic properties**

Pharmacotherapeutic group: Ophthalmologicals, other ophthalmologicals, ATC code: S01XA19

#### Mechanism of action and pharmacodynamic effects

The mechanism of action of Holoclar is the replacement of corneal epithelium and lost limbal stem cells in patients in which the limbus has been destroyed by ocular burns. During the corneal repair process, the administered stem cells are intended to multiply symmetrically and asymmetrically, producing differentiation and migration to regenerate corneal epithelium, as well as maintaining a reservoir of stem cells that can continually regenerate the corneal epithelium.

Conventional pharmacodynamic studies for Holoclar have not been performed

#### Clinical efficacy and safety

The efficacy and safety of the medicinal product was evaluated in three retrospective, case-series, non-randomised, non controlled studies (HLSTM01, HLSTM02 and HLSTM04), gathering all clinical information from all treated patients with available source documentation with a follow-up of up to 10 years. Efficacy and safety of Holoclar has also been evaluated in a prospective interventional, multinational, multicentre, open-label, uncontrolled study (HLSTM03 or HOLOCORE) involving a total of 80 patients and in its long term follow-up (HOLOCORE FOLLOW-UP or HOLOCORE-FU).

The HLSTM01 pivotal study was a multi-centre, case-series, non-controlled, non-randomised, retrospective clinical study performed to assess the potential efficacy and safety of Holoclar in a set of 106 patients of both genders, presenting a moderate to severe limbal stem cell deficiency (LSCD) due to ocular burns. Moderate to severe LSCD was defined according to an invasion of at least two quadrants of the corneal surface by superficial neo vessels.

A total of 104 patients, aged between 13 and 79 years (mean 46.8 years) were included in the primary efficacy analysis. At the time of product administration, the mean duration of the condition since the injury was 18 years (median 10 years), 99 % of patients had corneal opacity and 90 % of them had a severe impairment in visus (1/10<sup>th</sup> or less at Snellen chart). Success of the procedure was evaluated based on the presence of a stable corneal epithelium (i.e. absence of epithelial defects) without significant recurrence of neovascularisation (no more than one quadrant without central corneal involvement) at 12 months post-intervention. A total of 75 (72.1 %) treatments were reported with a successful outcome. These results were confirmed in a sensitivity analysis where superficial neovascularisation was evaluated by an independent assessor from blinded photos of patients' eyes taken before and after Holoclar implantation.

Additional clinically-relevant parameters were evaluated as secondary efficacy assessments.

The proportion of patients with symptoms (pain, burning or photophobia) significantly decreased from pre-surgery (40 patients with at least one symptom; 38.5 %) to one year after the procedure (12 patients; 11.5 %).

Fifty-one patients (49.0 %) had an improvement in visual acuity of at least one full line on a Snellen chart (or one category for the severely impaired cases). The proportion of patients with improvement in visual acuity was higher among those without a scar of the corneal stroma (15/18 patients, 83.3 %) than in those with scarring (36/81 patients, 44.4 %). When categorical values for visual acuity were converted into the Logarithm of the Minimum Angle of Resolution (LogMAR), 47 % of cases (40 over 85 with non-missing values) experienced an improvement equal or greater than 3 Snellen line equivalents.

Fifty-seven patients underwent a keratoplasty after the use of the product with a success rate of 42.1 % (N=24) one year after the corneal transplantation (i.e. with a stable corneal epithelium without significant recurrence of neovascularisation).

The HOLOCORE pivotal study was a multinational, multicentre, prospective, open-label, uncontrolled, interventional clinical trial to assess the efficacy and safety of Holoclar for restoration of corneal epithelium in patients with moderate to severe LSCD due to ocular burns. The study included a total of 76 adults and 4 paediatric patients of both genders. The paediatric patients were included for safety assessment.

The primary efficacy endpoint was the percentage of patients with a success of transplantation at 12 months from the first treatment. Transplantation success was judged by Independent Assessors on the basis of 2D pictures to be successful in a 41% of adult patients with evaluable results one year after the first treatment, and 57.8% patients experienced a lowering in the grade of superficial corneal neovascularisation in the same period.

The proportion of patients experiencing success in transplantation as well as other improvements as judged by Site Investigators by direct instrumental and clinical evaluation of the patients was higher than that from Independent Assessors on pictures; specifically, Site Investigators judged the treatment overall outcome to be successful in 77.0% of the patients and 82% of the patients had no epithelial defects.

In addition, the success of transplantation judged by Independent Assessors was higher when assessed according to Global Consensus paper guidelines with 50.9% patients with favourable outcome. Similarly, the improvement in LSCD staging according to the Global Consensus paper guidelines was higher (60.9%) than the rate assessed using the quadrants method (57.8% of patients experienced a lowering in the grade of superficial corneal neo-vascularisation according to Independent Assessors).

At the final visit, 82% of patients who attended had no epithelial defects, 49.2% had normal limbal hyperaemia and 44.3% had normal corneal sensitivity. Long standing LSCD symptoms improved, 75.4% of patients had no burning presence, and 78.7% reported no more presence of pain. The general



vision had an improvement in Best Corrected Visual Acuity (BCVA) at all time points statistically significant ( $p < 0.001$ ), while general health was maintained overall.

Patients with successful Holoclar engraftment at the end of the HOLOCORE study (outcome one year after Holoclar implantation) entered the HOLOCORE-FU study designed to establish long term safety and tolerability of Holoclar implantation and to confirm the benefit up to six years from treatment. Efficacy was sustained during the entire follow-up period, with a minimum of 60.0% success at one year from transplantation (Day 1 of the HOLOCORE-FU study) to a maximum of 100% at six years from transplantation (Day 1800 of the HOLOCORE-FU study). For the long term safety and tolerability evaluation, the AEs were pooled for the Main and Follow-Up studies to also ensure the identification of potential safety pattern over an extended follow-up. No new severe adverse event occurred in the Follow-Up study; 1 case of corneal opacity related to Holoclar was reported.

In addition, two years after Holoclar implantation, patients who had undergone keratoplasty showed successful corneal transplantation: 85.7% ( $n/N = 12/14$  on evaluation based on the quadrants method and 93.3% ( $n/N = 14/15$ ) when success was based on Investigator's overall clinical judgement.

The study results also demonstrate the synergy between ACLSCT with Holoclar and keratoplasty in the treatment of LSCD.

#### Elderly

The HLSTM01 study enrolled a total of seven patients (6.7 % of the study population) with an age at baseline of 65 years or above, seven patients (24.1 %) were originally enrolled in HLSTM02 and 6 patients (8.2%) were included in HOLOCORE. Although limited with regard to the number of subjects, data from these studies showed a success rate and level of efficacy similar to that observed in the treated patients overall.

The long-term data collected in the HOLOCORE-FU study confirmed the safety of Holoclar as no related adverse events occurred while the efficacy rate was maintained. Two out of 4 patients followed up in the long-term study had a successful outcome: 1 maintained the success as in HOLOCORE and 1 became a success after the keratoplasty. Among the other two with failure outcome based on the measurement of CNV in quadrants, one was judged successful by the Investigator clinical assessment, for a final success rate of 75% by overall investigator judgment.

#### Paediatric population

The HLSTM01 and HLSTM02 studies enrolled a total of five patients aged 8–17 years. The profile of adverse reactions in those paediatric patients was not different from the adult population.

The HOLOCORE study enrolled 4 patients ranging from 6 to 13 years (2 males and 2 females). These few patients were not included in the efficacy analysis but all parameters showed level of efficacy similar to that observed in the treated patients overall. In the paediatric group 12 AEs occurred overall, none considered serious, 2 judged possibly related to the surgical procedure associated with Holoclar transplantation but none to Holoclar.

The long-term data collected in the HOLOCORE-FU study on the 2 paediatrics subjects (6 and 13 years) included in the study confirmed the safety of Holoclar as no related adverse events occurred. The efficacy outcome for these patients was unsuccessful, confirming the negative result in HOLOCORE for them at 1-year follow-up. No long-term information was provided on the other two paediatrics treated in the HOLOCORE study with successful outcome at 1-year and not enrolled in the Follow-Up study.

## **5.2 Pharmacokinetic properties**

The product is implanted locally.

The nature and intended clinical use of Holoclar are such that conventional pharmacokinetic studies on absorption, biotransformation and elimination are not applicable. Immunohistochemical analysis of cornea taken from patients receiving keratoplasty after Holoclar treatment demonstrated that the transplanted stem cells establish normal layers of stratified corneal epithelium, which do not migrate in the conjunctiva or downward and do not invade basal ocular structures.

### **5.3 Preclinical safety data**

Non-clinical safety data were limited to *in vitro* testing of tumorigenicity of the human autologous cell cultures. These tests included cell karyotype, adhesion independent growth (cell growth in soft agar) and growth factor-dependent proliferation. *In vitro* studies have revealed no evidence of anchorage-independent, growth factor independent growth, abnormal karyotype or immortalization events, indicative of tumorigenic potential.

The safety of Holoclar is demonstrated in the results obtained from the two retrospective clinical studies.

Conventional non-clinical reproductive and developmental toxicity studies are not considered relevant, given the nature and the intended clinical use of the autologous adult-cell product.

## **6. PHARMACEUTICAL PARTICULARS**

### **6.1 List of excipients**

Transport medium (Dulbecco's Modified Eagles Medium supplemented with L-glutamine)  
Fibrin support.

### **6.2 Incompatibilities**

There have been no formal compatibility studies with Holoclar therefore this medicinal product should not be used with other medicinal products during the post-surgical period until the corneal epithelium integrity is fully restored. Exceptions include non-topical antibiotics for prophylaxis and corticosteroids during the immediate post-operative period.

### **6.3 Shelf life**

36 hours.

Holoclar must be applied no later than 15 minutes after opening the primary container.

### **6.4 Special precautions for storage**

Store between 15° C–25° C

Do not refrigerate or freeze

Do not irradiate (e.g. X-rays)

Do not sterilise

Keep the steel primary container tightly closed to protect from bacterial, fungal and viral contamination.

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

Holoclar is supplied as one individual treatment dose contained in a screw-cap container. Each container contains 3.8 cm<sup>2</sup> of autologous human corneal epithelium attached on a fibrin support and covered with transport medium.

The container is put in a secondary plastic container which is then put in a sealed sterile plastic bag. The sealed bag is put in a non-sterile, thermally insulated box for organ transportation with a temperature monitor. Finally, the thermally insulated box is put in a zipped sealable bag for transportation.

## **6.6 Special precautions for disposal and other handling**

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

Holoclar must be transported within the facility in closed, break-proof, leak-proof containers.

This medicinal product contains biological material. Healthcare professionals handling Holoclar must take appropriate precautions (wearing gloves, protective clothing and eye protection) to avoid potential transmission of infectious diseases.

Holoclar is intended solely for autologous use. Prior to implantation the patient's identity should be carefully checked with the patient/donor identification on the shipment documentation and product container.

Any shaking, inverting or other mechanical stress of the Holoclar container should be avoided.

Holoclar must not be sterilised. The container and closure should be carefully visually inspected for any damage. If the Holoclar primary container is damaged, the visual appearance of the product is affected, and/or visual particulates are identified, the product must not be used and must be returned to the manufacturer. If the temperature monitored in the insulated box deviates from the storage conditions, contact the manufacturer.

See the educational material for further information.

### Measures to take in case of accidental exposure

Accidental exposure to of Holoclar must be avoided. In case of accidental exposure local guidelines on handling of human derived materials must be followed. Work surfaces and materials which have potentially been in contact with Holoclar must be decontaminated with appropriate disinfectant.

### Precautions to be taken for the disposal of the medicinal product

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

## **7. MARKETING AUTHORISATION HOLDER**

Holostem s.r.l.  
Via Glauco Gottardi 100  
41125 Modena  
Italy  
Telephone: +39 059 2058070  
Telefax: +39 059 2058115

## **8. MARKETING AUTHORISATION NUMBER(S)**

EU/1/14/987/001

## **9. DATE OF FIRST AUTHORISATION/RENEWAL OF THE AUTHORISATION**

Date of first authorisation: 17/02/2015  
Date of latest renewal: 22/02/2024

#### **10. DATE OF REVISION OF THE TEXT**

<{MM/YYYY}>

Detailed information on this medicinal product is available on the website of the European Medicines Agency <http://www.ema.europa.eu>.

## **ANNEX II**

- A. MANUFACTURER(S) OF THE BIOLOGICAL ACTIVE SUBSTANCE(S) AND MANUFACTURER(S) RESPONSIBLE FOR BATCH RELEASE**
- B. CONDITIONS OR RESTRICTIONS REGARDING SUPPLY AND USE**
- C. OTHER CONDITIONS AND REQUIREMENTS OF THE MARKETING AUTHORISATION**
- D. CONDITIONS OR RESTRICTIONS WITH REGARD TO THE SAFE AND EFFECTIVE USE OF THE MEDICINAL PRODUCT**

## **A. MANUFACTURER OF THE BIOLOGICAL ACTIVE SUBSTANCE AND MANUFACTURER RESPONSIBLE FOR BATCH RELEASE**

### Name and address of the manufacturer of the biological active substance

Holostem s.r.l.  
Via Glauco Gottardi,100, Modena, 41125, Italy

### Name and address of the manufacturer responsible for batch release

Holostem s.r.l.  
Via Glauco Gottardi,100, Modena, 41125, Italy

## **B. CONDITIONS OR RESTRICTIONS REGARDING SUPPLY AND USE**

Medicinal product subject to restricted medical prescription (see Annex I: Summary of Product Characteristics, section 4.2).

## **C. OTHER CONDITIONS AND REQUIREMENTS OF THE MARKETING AUTHORISATION**

- **Periodic safety update reports (PSURs)**

The requirements for submission of PSURs for this medicinal product are set out in the list of Union reference dates (EURD list) provided for under Article 107c(7) of Directive 2001/83/EC and any subsequent updates published on the European medicines web-portal.

## **D. CONDITIONS OR RESTRICTIONS WITH REGARD TO THE SAFE AND EFFECTIVE USE OF THE MEDICINAL PRODUCT**

- **Risk management plan (RMP)**

The marketing authorisation holder (MAH) shall perform the required pharmacovigilance activities and interventions detailed in the agreed RMP presented in Module 1.8.2 of the Marketing Authorisation and any agreed subsequent updates of the RMP.

An updated RMP should be submitted:

- At the request of the European Medicines Agency;
- Whenever the risk management system is modified, especially as the result of new information being received that may lead to a significant change to the benefit/risk profile or as the result of an important (pharmacovigilance or risk minimisation) milestone being reached.

- **Additional risk minimisation measures**

The following additional risk minimisation measures are necessary for the safe and effective use of the product:

Educational material for healthcare professionals to provide training on the appropriate use of the product and to minimise risks, addressing the key elements of:

- Patient selection
- Traceability of patients and use of identifiers
- Biopsy, implant and follow up care

- Contraindicated use of eye drops containing benzalkonium chloride
- Concomitant use of topical lidocaine or anaesthetics containing adrenaline must be avoided
- Risk of glaucoma and blepharitis
- Encouraging enrolment in the registry
- Reporting suspected side effects

The education material should also include both an Educational Manual and a training programme which will incorporate verification of physicians' comprehension of the training provided.

Educational material for patients and/or carers to address the following key elements:

- Contraindicated use of eye drops containing benzalkonium chloride
- Side effects of post-transplant treatment with antibiotics and corticosteroids
- Inform patients of the registry
- Reporting suspected side effects

**ANNEX III**  
**LABELLING AND PACKAGE LEAFLET**



## **A. LABELLING**

**PARTICULARS TO APPEAR ON THE OUTER PACKAGING**

**ZIPPED SEALABLE BAG**

**1. NAME OF THE MEDICINAL PRODUCT**

Holoclar 79,000 - 316,000 cells/cm<sup>2</sup> living tissue equivalent  
*Ex vivo* expanded autologous human corneal epithelial cells containing stem cells.

**2. STATEMENT OF ACTIVE SUBSTANCE(S)**

This product contains cells of human origin.  
Holoclar consists of a transparent circular sheet of 300,000 to 1,200,000 viable autologous human corneal epithelial cells (79,000 - 316,000 cells/cm<sup>2</sup>), including on average 3.5 % (0.4 to 16 %) limbal stem cells, and stem cell-derived transient amplifying and terminally differentiated cells, attached on a supportive 2.2 cm diameter fibrin layer and maintained in the transport medium.

**3. LIST OF EXCIPIENTS**

Transport medium (Dulbecco's Modified Eagles Medium supplemented with L-glutamine).  
Fibrin support.

**4. PHARMACEUTICAL FORM AND CONTENTS**

Living tissue equivalent.  
Each container contains 3.8 cm<sup>2</sup> of autologous human corneal epithelium attached to a fibrin support and immersed in transport medium.

**5. METHOD AND ROUTE(S) OF ADMINISTRATION**

For single use only.  
Read the package leaflet before use.  
For implantation.

**6. SPECIAL WARNING THAT THE MEDICINAL PRODUCT MUST BE STORED OUT OF THE SIGHT AND REACH OF CHILDREN**

Keep out of the sight and reach of children.

**7. OTHER SPECIAL WARNING(S), IF NECESSARY**

Potentially infected biological material.  
Handle with care, avoid, any shaking, inverting or other mechanical stress.  
For autologous use only.

**8. EXPIRY DATE**

EXP: Day / Month / Year  
At time: Hour / Minute (CET)

**9. SPECIAL STORAGE CONDITIONS**

Store between 15° C–25° C  
Keep the steel primary container tightly closed in order to protect from bacterial, fungal and viral contamination  
Do not freeze  
Do not sterilise  
Do not irradiate (e.g. X-rays)  
Each batch is shipped in a temperature-controlled thermally insulated box for organ transplant.

**10. SPECIAL PRECAUTIONS FOR DISPOSAL OF UNUSED MEDICINAL PRODUCTS OR WASTE MATERIALS DERIVED FROM SUCH MEDICINAL PRODUCTS, IF APPROPRIATE**

This medicine contains potentially infected biological material. Unused medicine or waste material must be disposed of in compliance with the local guidelines on handling of waste of human-derived material.

**11. NAME AND ADDRESS OF THE MARKETING AUTHORISATION HOLDER**

Holostem s.r.l., Via Glauco Gottardi 100, 41125 Modena, Italy

**12. MARKETING AUTHORISATION NUMBER(S)**

EU/1/14/987/001

**13. BATCH NUMBER, DONATION AND PRODUCT CODES**

Batch:

**14. GENERAL CLASSIFICATION FOR SUPPLY**

Medicinal product subject to medical prescription.

**15. INSTRUCTIONS ON USE****16. INFORMATION IN BRAILLE**

Justification for not including Braille accepted

**17. UNIQUE IDENTIFIER – 2D BARCODE**

<Not applicable.>

**18. UNIQUE IDENTIFIER – HUMAN READABLE DATA**

<Not applicable.>

**PARTICULARS TO APPEAR ON THE OUTER PACKAGING**

**PLASTIC BAG (TERTIARY)**

**1. NAME OF THE MEDICINAL PRODUCT**

Holoclar 79,000 - 316,000 cells/ cm<sup>2</sup> living tissue equivalent.  
*Ex vivo* expanded autologous human corneal epithelial cells containing stem cells.

**2. STATEMENT OF ACTIVE SUBSTANCE(S)**

This product contains cells of human origin.  
Holoclar consists of a transparent circular sheet of 300,000 to 1,200,000 viable autologous human corneal epithelial cells (79,000 - 316,000 cells/ cm<sup>2</sup>), including on average 3.5 % (0.4 to 16 %) limbal stem cells, and stem cell-derived transient amplifying and terminally differentiated cells, attached on a supportive 2.2 cm diameter fibrin layer and maintained in the transport medium.

**3. LIST OF EXCIPIENTS**

Transport medium (Dulbecco's Modified Eagles Medium supplemented with L-glutamine)  
Fibrin support.

**4. PHARMACEUTICAL FORM AND CONTENTS**

Living tissue equivalent.  
Each container contains 3.8 cm<sup>2</sup> of autologous human corneal epithelium attached to a fibrin support and immersed in transport medium.

**5. METHOD AND ROUTE(S) OF ADMINISTRATION**

For single use only.  
Read the package leaflet before use.  
For implantation.

**6. SPECIAL WARNING THAT THE MEDICINAL PRODUCT MUST BE STORED OUT OF THE SIGHT AND REACH OF CHILDREN**

Keep out of the sight and reach of children.

**7. OTHER SPECIAL WARNING(S), IF NECESSARY**

Potentially infected biological material.  
Handle with care, avoid any shaking, inverting or other mechanical stress.  
For autologous use only.

**8. EXPIRY DATE**

EXP: Day / Month / Year  
At time: Hour / Minute (CET)

**9. SPECIAL STORAGE CONDITIONS**

Store between 15° C-25° C  
Keep the steel primary container tightly closed in order to protect from bacterial, fungal and viral contamination  
Do not freeze  
Do not sterilise  
Do not irradiate (e.g. X-rays)  
Each batch is shipped in a temperature-controlled thermally insulated box for organ transplant.

**10. SPECIAL PRECAUTIONS FOR DISPOSAL OF UNUSED MEDICINAL PRODUCTS OR WASTE MATERIALS DERIVED FROM SUCH MEDICINAL PRODUCTS, IF APPROPRIATE**

This medicine contains potentially infected biological material. Unused medicine or waste material must be disposed of in compliance with the local guidelines on handling of waste of human-derived material.

**11. NAME AND ADDRESS OF THE MARKETING AUTHORISATION HOLDER**

Holostem s.r.l., Via Glauco Gottardi 100, 41125 Modena, Italy

**12. MARKETING AUTHORISATION NUMBER(S)**

EU/1/14/987/001

**13. BATCH NUMBER, DONATION AND PRODUCT CODES**

Batch  
Patient's Forename and Surname:  
Patient's Date of Birth:

**14. GENERAL CLASSIFICATION FOR SUPPLY**

Medicinal product subject to medical prescription.

**15. INSTRUCTIONS ON USE****16. INFORMATION IN BRAILLE**

Justification for not including Braille accepted

**17. UNIQUE IDENTIFIER – 2D BARCODE**

<Not applicable.>

**18. UNIQUE IDENTIFIER – HUMAN READABLE DATA**

<Not applicable.>

**MINIMUM PARTICULARS TO APPEAR ON SMALL IMMEDIATE PACKAGING UNITS**  
**SCREW-CAP CONTAINER**

**1. NAME OF THE MEDICINAL PRODUCT AND ROUTE(S) OF ADMINISTRATION**

Holoclar

**2. METHOD OF ADMINISTRATION**

**3. EXPIRY DATE**

EXP:

DATE:

HOUR: (Time zone)

**4. BATCH NUMBER<, DONATION AND PRODUCT CODES>**

Batch

**5. CONTENTS BY WEIGHT, BY VOLUME OR BY UNIT**

**6. OTHER**

M.A.H: Holostem s.r.l.



**B. PACKAGE LEAFLET**

## Package leaflet: Information for the patient

### Holoclar 79,000 – 316,000 cells/cm<sup>2</sup> living tissue equivalent

*Ex vivo* expanded autologous human corneal epithelial cells containing stem cells.

▼ This medicine is subject to additional monitoring. This will allow quick identification of new safety information. You can help by reporting any side effects you may get. See the end of section 4 for how to report side effects.

**Read all of this leaflet carefully before you are given this medicine because it contains important information for you.**

- Keep this leaflet. You may need to read it again.
- If you have any further questions, ask your surgeon.
- If you get any side effects, talk to your surgeon. This includes any possible side effects not listed in this leaflet. See section 4.

### What is in this leaflet

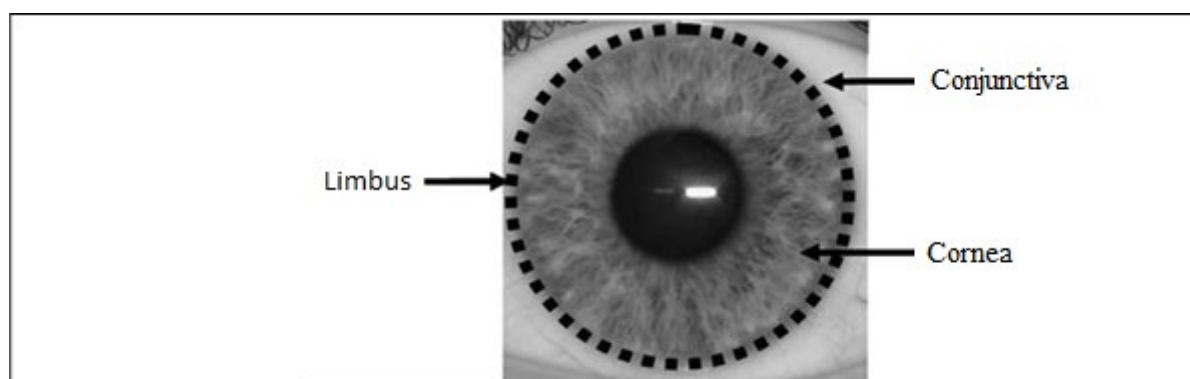
1. What Holoclar is and what it is used for
2. What you need to know before you are given Holoclar
3. How Holoclar is given
4. Possible side effects
5. How Holoclar is stored
6. Contents of the pack and other information

#### 1. What Holoclar is and what it is used for

Holoclar is a medicine used for replacing damaged cells of the cornea (the clear layer that covers the coloured iris at the front of the eye) including limbal cells which normally help to maintain the health of your eye.

Holoclar consists of a layer of your own cells which have been grown (*ex vivo* expanded) from a sample of limbal cells taken from your eye during a small surgical procedure called a biopsy. Each preparation of Holoclar is made individually and is for a single treatment only, although treatments can be repeated. The cells used to make Holoclar are known as autologous limbal cells:

- **Autologous** means that they are your own cells.
- The **limbus** is part of the eye. It is the rim surrounding the coloured centre (iris) of your eye. The picture shows where the limbus is in your eye.
- The limbus contains **limbal cells** which normally help to maintain the health of your eye and some of these are **stem cells** which can make new cells. These new cells can replace the damaged cells in your eye.



Holoclar is implanted to repair the damaged surface of the eye in adults. When the eye is badly damaged by physical or chemical burns, lots of scarring can occur and the limbus can be damaged. Damage to the limbus stops normal healing, which means that the damage to your eye is never properly repaired.

By taking some healthy limbal cells, a new layer of healthy tissue is grown in the laboratory on a supporting layer of fibrin, a protein scaffold. This layer of tissue is then implanted by a surgeon into the damaged cornea helping your eye to heal normally.

## **2. What you need to know before you are given Holoclar**

### **You must not be given Holoclar:**

- if you are allergic to any of the ingredients of this medicine (listed in section 6) or to bovine serum and mouse cells

### **Warnings and precautions**

Talk to your surgeon before you are given Holoclar.

Holoclar is prepared individually from your own cells to match you, and must not be used for anyone other than yourself.

If you have an acute eye infection or swollen, red (inflamed) eyes, your treatment should be delayed until you have recovered.

When Holoclar is made, two ingredients from animals are used. One is foetal bovine serum which is from cows and is used to help grow your cells. The other ingredient is a special kind of inactivated mouse cell which is used to grow your limbal cells. If you are allergic to either of these ingredients, you will not be able to be given this medicine (see above under ‘You must not be given Holoclar’).

If you have any of the following problems with your eyes, they should be treated before this medicine is used:

- Uneven eyelids
- Scarring of the conjunctiva (the protective layer over the white of your eye) with damage where it joins to the inside of the eyelids (fornix shortening)
- Inability for your eye to sense pain (anaesthesia of the cornea or conjunctiva or hypoaesthesia)
- Growth of the conjunctiva over the cornea (pterygium)
- Severe dry eye.

### **Other cases in which Holoclar cannot be used**

Even if the surgeon has already taken a small sample of limbal cells (a biopsy) needed to produce the medicine, it is possible that you will not be able to have treatment with Holoclar. This is the case if the biopsy is not good enough to make Holoclar, the cells cannot be grown in the laboratory or the grown cells do not meet all the quality requirements. Your surgeon will inform you about this.

### **Children and adolescents**

Only a very small number of children have been treated so far, so there is limited data on whether the treatment is safe for use in children or how effective it may be.

### **Kidney and liver problems**

Please talk with your surgeon before the start of treatment if you have liver or kidney disease.

### **Other medicines and Holoclar**

Some eye-drops contain a preservative called 'benzalkonium chloride'. This ingredient will damage the cells of which Holoclar is made. Do not use eye-drops containing benzalkonium chloride and/or other preservatives. Ask your doctor or pharmacist for advice.

### **Pregnancy and breast-feeding**

If you are pregnant, think you might be pregnant or you are breast-feeding, treatment with this medicine should be delayed.

### **Driving and using machines**

Holoclar is given by surgery on your eye and this will impact on your ability to drive and use machines. Therefore, do not drive or use machines after having Holoclar put in your eye until your surgeon tells you that it is safe to do so. Follow their advice carefully.

## **3. How Holoclar is given**

Holoclar can only be prescribed and given by an eye surgeon in a hospital. Treatment with Holoclar is a two-step procedure.

### **Visit 1: Biopsy taken**

On the first visit, the surgeon will carry out a biopsy, which means removing a very small amount of tissue containing limbal cells (from your eye). Before the biopsy, the surgeon will give you eye-drops to anaesthetise your eye and surgically take the biopsy. This biopsy will then be used to make Holoclar. After biopsy has been taken, your surgeon will prescribe a course of antibiotics for you to reduce the chance of an infection.

It will take several weeks to produce Holoclar.

### **Visit 2: Holoclar implantation**

On the second visit the surgeon will:

- Anaesthetise your eye
- Remove the scarred surface of the cornea
- Replace it with Holoclar

On the day of surgery, the surgeon will anaesthetise your eye and then will attach the edge of your new cornea with stitches to make sure that Holoclar stays in place. Your eyelid will be taped closed for three days and your eye will be bandaged for 10 to 15 days after the implantation.

After surgery, you will be prescribed a course of medicines to ensure full healing: antibiotics to reduce the chance of an infection and steroids to reduce swelling and irritation. It is **very** important that you take all the medicines prescribed by your surgeon, otherwise Holoclar may not work.

Please read the package leaflets for the individual medicines you are given for further information on these medicines.

Ask your surgeon if you have any further questions about the treatment with Holoclar.

## **4. Possible side effects**

Like all medicines, this medicine can cause side effects, although not everybody gets them.

Most side effects affect the eye, some of which are caused by the surgery or associated pharmacologic treatment. Most side effects are mild and disappear in the weeks after surgery.

The most serious side effects are problem with cornea (erosion) and perforation of the cornea, caused by treatment failure, which may occur within the 3 months from Holoclar implantation. In such a case, please contact your surgeon.

**Common:** may affect up to 1 in 10 people

- Bleeding around the site of the operation where Holoclar was inserted
- Problems with cornea (erosion)
- Increased pressure in the eye (glaucoma)
- Eye pain
- Inflammation of the cornea
- Inflammation of the eyelids (blepharitis)
- Eye complications due to the operation

**Uncommon:** may affect up to 1 in 100 people

- Eye disorders - stickiness of the eyelid, bloodshot eyes, swelling and inflammation of the eye, perforation, thinning and opacity of the cornea, eye irritation, turning of the eyelid, inwards growth of the eyelashes, dilation of the pupil and lacrimation
- Sensitivity to light
- Overgrowth around the implant (metaplasia)
- Sensation of foreign body in the eye
- Infection of the cornea
- Conjunctivitis
- The stitches break
- Fainting
- Headache
- Nausea
- Vomiting
- Bleeding from the eye lid skin
- Allergic dermatitis

### **Reporting of side effects**

If you get any side effects, talk to your surgeon. This includes any possible side effects not listed in this leaflet. You can also report side effects directly via [the national reporting system listed in Appendix V](#). By reporting side effects you can help provide more information on the safety of this medicine.

## **5. How Holoclar is stored**

The following information is intended for doctors only.

Keep this medicine out of the sight and reach of children.

Do not use this medicine after the expiry date which is stated on the label after EXP.

Do not store above 25° C or below 15° C.

Do not refrigerate or freeze.

Keep Holoclar within the steel container in the plastic bag until surgery. This is to protect it from contamination by bacteria.

Holoclar must not be irradiated or sterilised.

Since this medicine will be used during your surgery, the hospital staff are responsible for the correct storage of the medicine before and during its use, as well as for the correct disposal.

## 6. Contents of the pack and other information

### What Holoclar contains

- The active substance consists of 300,000 - 1,200,000 of your living eye cells, on average 3.5 % of which are stem cells. Each square centimetre of Holoclar contains 79,000 - 316,000 cells.
- There are two excipients: one is fibrin - a clear supportive layer used to keep Holoclar intact, the other one is a liquid containing amino acids, vitamins, salts and carbohydrates to store the cells in the vial called Dulbecco's Modified Eagles Medium supplemented with L-glutamine.

### What Holoclar looks like and contents of the pack

Holoclar is a layer of cells for implantation into your eye. The cells are kept alive in a small sterile container. The medicine is put in several layers of packaging which protect the medicine from bacteria and ensures that Holoclar is kept at a stable temperature for 36 hours, if stored at room temperature (15-25°C).

Each package contains an individual treatment dose which is large enough to cover your cornea.

### Marketing Authorisation Holder and Manufacturer

Holostem s.r.l.  
Via Glauco Gottardi 100,  
Modena, 41125,  
Italy  
Phone: +39 059 2058070  
Fax: +39 059 2058115

**This leaflet was last revised in <{MM/YYYY}>**

### Other sources of information

Detailed information on this medicine is available on the European Medicines Agency web site:  
<http://www.ema.europa.eu>.

---

The following information is intended for healthcare professionals only

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

Holoclar must be transported within the facility in closed, break-proof, leak-proof containers.

This medicinal product contains human corneal epithelial cells. Healthcare professionals handling Holoclar must take appropriate precautions wearing gloves, protective clothing and eye protection to avoid potential transmission of infectious diseases.

### Preparation prior to administration

Holoclar is an advanced therapy medicinal product ready to be implanted.  
Holoclar must be administered by an appropriately trained and qualified surgeon.

### Administration

#### *Implantation*

Holoclar is intended solely for autologous use and must not, under any circumstances, be administered to other patients. Holoclar must not be administered if the information on the product labels and lot number do not match the patient's identity.

Holoclar should be administered under aseptic conditions in conjunction with limbal peritomy, undermining of the conjunctiva and excision of the corneal fibrovascular tissue in preparation of the defect bed. Next, the cultured tissue is fitted under the undermined conjunctiva. The excess of insert is trimmed, and the edge covered with the conjunctiva applying 2 or 3 stitches (sutures) of vicryl or silk 8/0 in order to form a physical seal of the lesion and to secure the implant. The eyelids are kept closed over the insert with a steri-strip band.

Holoclar is generally implanted under topical retrobulbar or parabolbar anaesthesia. Other anaesthesiology procedures may be followed at the discretion of the surgeon, excluding the use of lidocaine local anaesthesia or anaesthetics containing adrenaline must be avoided.

Concomitant use of Holoclar with eye-drops containing benzalkonium chloride, and/or other preservatives is not recommended.

The procedure of Holoclar administration includes the use of antibiotics and corticosteroids. Following implantation, an appropriate regimen of topical and systemic anti-inflammatory and prophylactic antibiotic treatment must be given.

The implantation must be followed by an appropriate monitoring schedule.

#### Measures to take in case of accidental exposure

In case of accidental exposure local guidelines on handling of human-derived material must be followed. Work surfaces and materials which have potentially been in contact with Holoclar must be decontaminated with appropriate disinfectant.

#### Precautions to be taken for the disposal of the medicinal product

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