

The Ocular Outcomes of Amniotic Membrane Transplantation in Patients with Stevens-Johnson Syndrome and Toxic Epidermal Necrolysis: A Systematic Review

Jessica Pickens, B.S.¹; Madelaine Pickens, B.S., B.A. ¹; Sharon Duffy, MLIS²; Maria Bernal, M.D.³; Nicholas Culotta, M.D.⁴

¹LSU Health Sciences Center, School of Medicine, New Orleans, LA; ²LSUHSC, Division of Libraries; ³LSUHSC, Department of Ophthalmology; ⁴LSUHSC, Department of Dermatology



Introduction

- Stevens-Johnson Syndrome (SJS) and Toxic Epidermal Necrolysis (TEN) are rare yet severe mucocutaneous autoimmune reactions triggered by medications or infections.
- Overactivation of the immune system causes widespread keratinocyte death, leading to the detachment and necrosis of the epidermis in the skin and the surface epithelial layer of mucosae, including the surface of the eye.¹
- SJS and TEN describe the same disease process and are distinguished by severity, measured by percentage of body surface area (BSA) affected.
 - SJS → less than 10% of BSA
 - SJS/TEN → between 10-30% of BSA
 - TEN → greater than 30% of BSA²
- Amniotic membrane transplantation (AMT) is used to treat acute and chronic ocular complications by promoting healing on the ocular surface in these patients.
 - AMT helps prevent inflammation, fibrosis, and angiogenesis and serves as a protective barrier.^{3, 4}

Objectives

- Despite the growing number of studies emerging on the use of AMT in the treatment of SJS/TEN, the data has not yet been summarized using a systematic approach.
- Our systematic review aims to synthesize current clinical evidence on the ocular outcomes following AMT in patients affected by SJS/TEN and to provide clarity on the efficacy of AMT in this population.

Methods

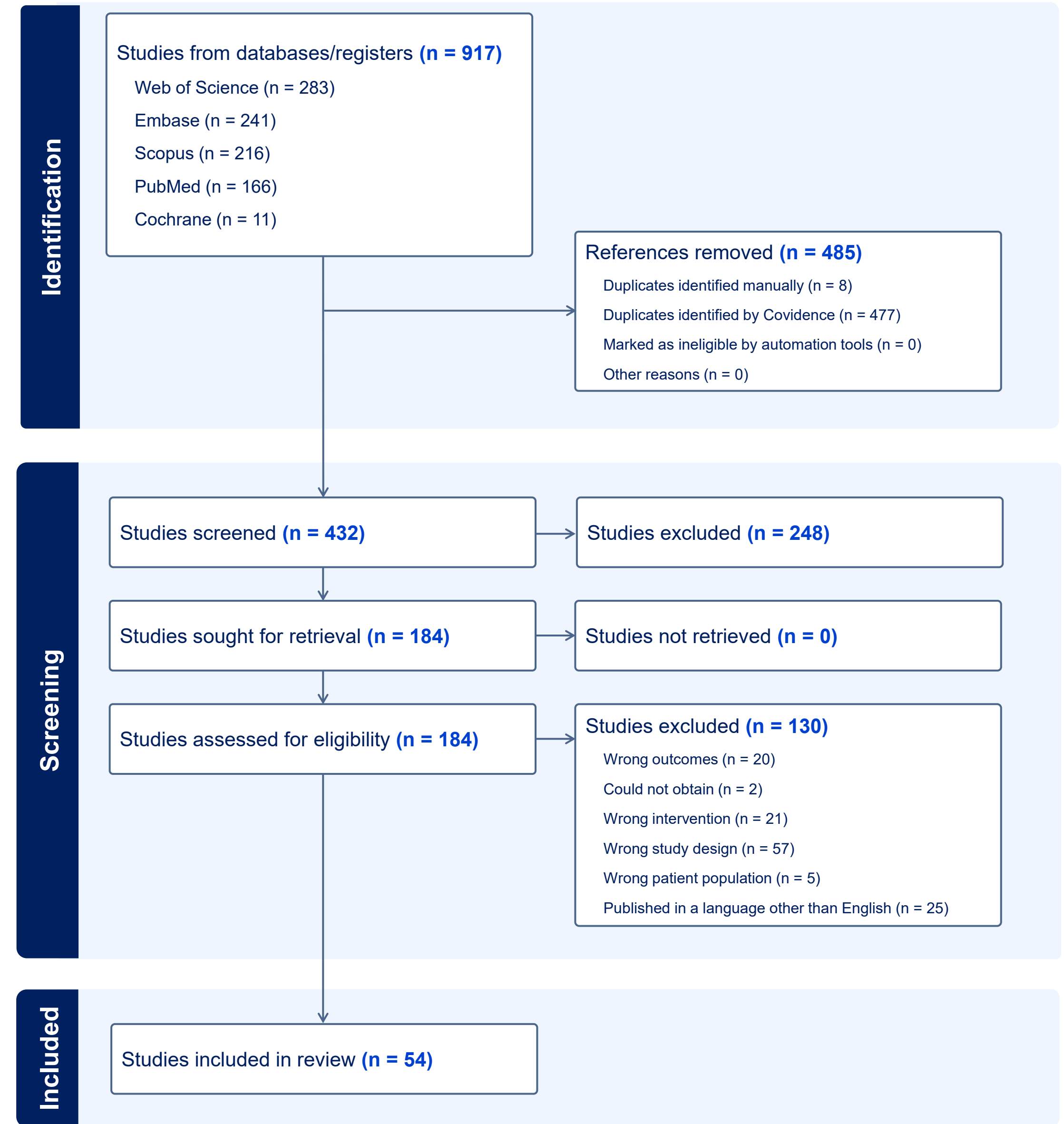


Figure 1. PRISMA Flow Diagram from Covidence™

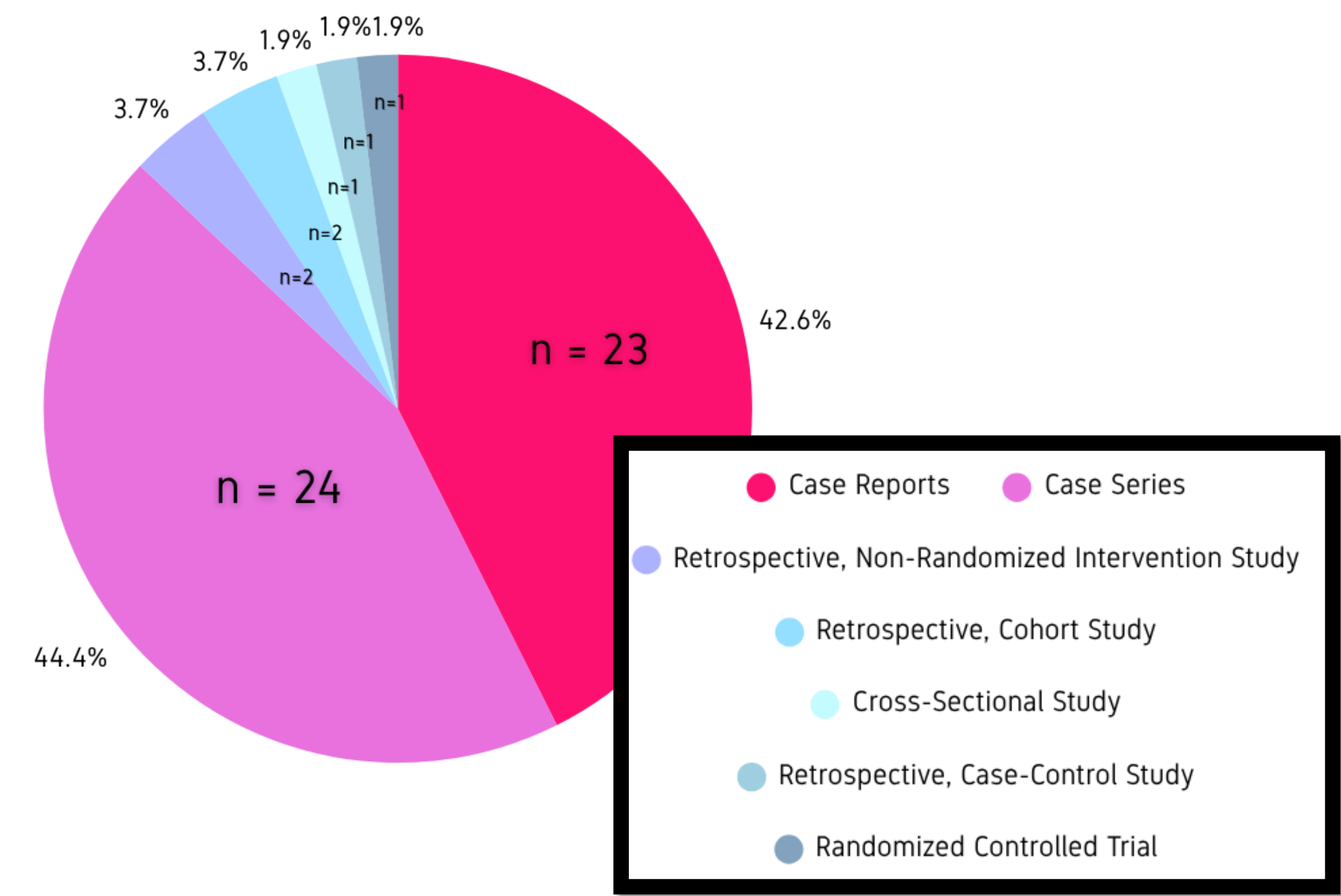


Figure 2. Study Types Included in Systematic Review

Results

Study ID	AMT Surgical Technique	Use of Sutures/Glue	AMT Type	Outcomes Summary	Study Type	Risk of Bias
Ahmad et al. 2017	25/32 (78%) patients: standard AMT + ProKera; 5/32 (16%) patients: standard AMT with sutures; 1/32 (3%) patients: ProKera; 1/32 (3%) patients: not reported	Sutures (eyelid) with standard AMT; no sutures with ProKera	Cryopreserved	93.5% of patients had complete resolution of ocular symptoms.	Case series	Low
Barua et al. 2012	Sutureless AMT with symblepharon ring	None	Cryopreserved	Near normal BCVA in both eyes; mild eyelid and conjunctival symptoms.	Case report	Low
Bay et al. 2019	Sutureless AMT with symblepharon ring (open fornix conformer)	None	Fresh	No chronic complications.	Case report	Low
Ceylan et al. 2023	Sutureless AMT with symblepharon ring (pediatric nasogastric tube)	None	Cryopreserved	Mild complications overall; moderate rate of dry eye; low rate of lid margin and conjunctival scarring.	Case series	Low
Chan et al. 2021	Scleral conformer wrapped in AM and fibrin glue	Fibrin glue	Cryopreserved	Normal BCVA; mild symblepharon, post-op Candida infection.	Case report	Low
Chen et al. 2024	ProKera	None	Cryopreserved	Conjunctival squamous metaplasia resulted in removal of AMT in 1 eye. Normal BCVA; mild symblepharon and corneal scarring.	Case report	Low
Cheung et al. 2016	AM sutured to custom symblepharon ring; no sutures attaching ring to eye, sutures used to close eyelids and hold ring in place	Sutures (eyelid)	Cryopreserved	Normal BCVA, mild symblepharon and conjunctival scarring.	Case report	Low
DiPasquale et al. 2005	Standard AMT with sutures	Sutures (eyelid)	Cryopreserved	Mild eyelid and conjunctival scarring in one eye.	Case report within a case series	Low
Elhusseiny et al. 2021	Standard AMT with sutures and symblepharon ring (IV tubing)	Sutures (eyelid)	Cryopreserved	No chronic complications.	Case report	Low
Gregory et al. 2011	7/10 (70%) patients: standard AMT with sutures; 3/10 (30%) patients: ProKera; 10/10 (100%) patients: AM on upper external eyelid	Sutures (eyelid) with standard AMT; no sutures with ProKera	Cryopreserved	Normal or near normal BCVA in all eyes; high rate of mild eyelid complications; moderate rate of dry eye and symblepharon; low rates of conjunctival and corneal complications.	Case series	Low
Gregory et al. 2016	100% patients: AMT on palpebral conjunctiva; standard AMT with sutures or ProKera were used for ocular surface	Sutures (eyelid) with standard AMT; no sutures with ProKera	Cryopreserved	Normal BCVA in 97% of patients; moderate rates of conjunctival complications; low rates of dry eye, eyelid, and corneal complications.	Case series	Low
Hess et al. 2012	Standard AMT with sutures	Sutures (eyelid)	Cryopreserved	Normal BCVA; no chronic complications.	Case report	Low
Hsu et al. 2012	Standard AMT with sutures and symblepharon ring (premade ring or IV tubing) or ProKera	Sutures (eyelid) with standard AMT; no sutures with ProKera	Cryopreserved	The rate of poor ocular outcomes was statistically lower for eyes treated with AMT in the acute phase compared to untreated eyes (p<0.05).	Case control	Serious
Hwang et al. 2012	AMT with symblepharon ring, use of sutures not reported	Not reported	Not reported	Normal BCVA; no chronic complications.	Case report	Low
Jenkins et al. 2020	AMT with symblepharon ring	Not reported	Not reported	Near normal BCVA; no chronic complications.	Case report	Moderate
John et al. 2002	3/4 (75%) eyes: standard AMT with sutures; 1/4 (25%) eyes: AMT with symblepharon ring	Sutures (eyelid) with standard AMT; no sutures with symblepharon ring	Cryopreserved	Near normal BCVA; moderate rates of mild eyelid, conjunctival, and corneal complications.	Case series	Low
Kim et al. 2013	Standard AMT with sutures	Sutures (eyelid)	Cryopreserved	Variable BCVA; less severe cases of SJS/TEN resulted in better outcomes.	Case series	Low
Kobayashi et al. 2006	Standard AMT with sutures	Sutures (eyelid)	Cryopreserved	Normal BCVA; mild symblepharon, conjunctival, and corneal complications.	Case report	Low
Kolomeyer et al. 2013	ProKera	None	Cryopreserved	Normal BCVA; no chronic complications.	Case report	Low
Kwong et al. 2024	AMT, type unspecified	Not reported	Not reported	No chronic complications.	Case report	Moderate
López-García et al. 2014	Standard AMT with sutures and symblepharon ring	Sutures (eyelid)	Cryopreserved	Moderate visual impairment; low rates of dry eye, eyelid, symblepharon, and corneal complications.	Case series	Low
Ma et al. 2016	5/9 (55%) patients: standard AMT with sutures; multiple sheets of AM; 4/9 (44%) patients: AMT with symblepharon ring (IV tubing); single sheet of AM	Sutures (eyelid) with standard AMT; no sutures with symblepharon ring	Cryopreserved	Near normal BCVA in majority of eyes; moderate to severe visual impairment in others; high rate of dry eye; low rates of eyelid, symblepharon, conjunctival, and corneal complications.	Case series	Low
Ma et al. 2021	Sutured or glued (cyanoacrylate) AMT; cryopreserved	Sutured (eyelids) or cyanoacrylate glue (eyelids)	Cryopreserved	Ocular complications were significantly reduced when patients received AMT vs < 7 days after disease onset.	Retrospective, non-randomized intervention study	Critical
Mahmood et al. 2021	ProKera	None	Cryopreserved	Near normal BCVA; mild dry eye, eyelid, symblepharon, and corneal complications.	Case report	Moderate
Mortensen et al. 2023	Group 1: Dehydrated AMT with symblepharon ring (IV tubing) covering lid margins and ocular surface. Group 2: ProKera placed over dehydrated AMT covering lid margins and ocular surface. Both groups: sutures or cyanoacrylate glue used to secure dehydrated AMT to eyelids.	Sutured (eyelids) or cyanoacrylate glue (eyelids)	Dehydrated +/- ProKera (cryopreserved)	No significant difference in BCVA between cryopreserved vs. dehydrated AMT groups; rate of dry eye, madarosis, and symblepharon significantly higher in cryopreserved AMT group; rate of corneal complications was significantly higher in sutured AMT vs. glued AMT group. Normal or moderate visual impairment in the majority of eyes; moderate rates of dry eye, eyelid, symblepharon, and corneal complications; low rate of conjunctival complications.	Retrospective, non-randomized intervention study	Critical
Nassim et al. 2021	AMT, unspecified type	Not reported	Not reported	Mild dry eye.	Case report	Low
Pradeep et al. 2022	Standard AMT with sutures	Sutures (eyelid)	Not reported	Moderate visual impairment; high rate of dry eye, moderate rate of eyelid complications, low rate of corneal complications.	Case series	Low
Pruett et al. 2014	Sutureless AMT with AM wrapped around symblepharon ring (polymethylmethacrylate)	None	Cryopreserved	Normal BCVA; mild symblepharon and conjunctival complications.	Case report	Low
Rashad et al. 2024	Group 1: sutured AMT with symblepharon ring. Group 2: sutureless AMT with cyanoacrylate glue with symblepharon ring.	Sutured (eyelids) or cyanoacrylate glue (eyelids)	Cryopreserved	Moderate visual impairment; no statistical difference in outcomes between sutured vs. glued AMT groups.	Retrospective cohort	Low
Shammas et al. 2018	6/8 (75%) patients: standard AMT with sutures; 2/8 (25%) patients: ProKera	Sutures (eyelids) with standard AMT; none with ProKera	Cryopreserved	Moderate visual impairment; complications were more severe in ProKera vs. standard AMT group.	Case series	Low
Shanbhag et al. 2019 #1	Sutureless AMT with symblepharon ring (IV tubing and cyanoacrylate glue)	Cyanoacrylate glue (eyelids)	Cryopreserved	Moderate visual impairment; 100% rate of dry eye, eyelid, and conjunctival complications; low rates of symblepharon and corneal complications.	Case series	Low
Shanbhag et al. 2019 #2	31/55 (56%) eyes: AMT with sutures or cyanoacrylate glue with symblepharon ring; 24/55 (44%) eyes: ProKera	Sutures (eyelids) or cyanoacrylate glue (eyelids) with standard AMT; none with ProKera	Cryopreserved	Mild to moderate visual impairment; high rates of dry eye; moderate rates of eyelid, symblepharon, conjunctival, and corneal complications.	Retrospective cohort	Critical
Shanbhag et al. 2022	AMT with sutures or glue; or ProKera	Sutures	Cryopreserved	Normal BCVA; moderate rates of dry eye and eyelid complications. Patients who received AMT in the acute phase of disease had comparable NEI-VFQ-25 scores with healthy subjects on all subscales except ocular pain and mental health, which were significantly reduced.	Cross-sectional, observational	Low
Sharma et al. 2016	Sutureless AMT with fibrin glue and symblepharon ring	Fibrin glue (conjunctiva)	Cryopreserved	BCVA was significantly better in AMT vs. medically treated group. All categories of ocular complications were significantly reduced in the AMT vs. medically treated group. In the AMT group, BCVA was normal, and there were low rates of conjunctival and corneal complications.	Randomized controlled trial	Some concerns
Sharma et al. 2022	AMT with cyanoacrylate glue and symblepharon ring (infant feeding tube)	Cyanoacrylate glue (eyelids)	Cryopreserved	Normal BCVA after AMT; patient required MMG to manage chronic lid-related keratopathy.	Case report	Moderate
Shay et al. 2010	ProKera	None	Cryopreserved	Normal BCVA; mild symblepharon, conjunctival, and corneal complications; 1 eye required MMG to manage eyelid complications.	Case report	Moderate
Sims et al. 2022	AMT with cyanoacrylate glue and fibrin glue with symblepharon ring (IV tubing)	Cyanoacrylate glue (eyelids), fibrin glue (palpebral conjunctiva)	Cryopreserved	Normal BCVA; severe dry eye requiring scleral contact lenses; mild conjunctival complications.	Case report	Moderate
Tandon et al. 2007	Standard AMT with sutures	Sutures (eyelids)	Cryopreserved	Normal BCVA; mild eyelid, symblepharon, conjunctival, and corneal complications.	Case report	Low
Tonlinus et al. 2013	ProKera	None	Cryopreserved	Normal or unreported BCVA; mild symblepharon and conjunctival complications.	Case series	Moderate
Tsai et al. 2023	ProKera in acute phase; AMT and AM patch graft in chronic phase	Not reported	AMT not reported; ProKera (cryopreserved)	Severe visual impairment; severe dry eye, eyelid, symblepharon, conjunctival, and corneal complications.	Case report	High
Yang et al. 2021	Standard AMT with sutures and symblepharon conformer	Sutures (eyelids)	Cryopreserved	Moderate rate of mild to moderate visual impairment; moderate rate of severe visual impairment; high rates of dry eye and eyelid complications; moderate rates of symblepharon, conjunctival, and corneal complications; low rate of infection.	Case series	Low
Zhang et al. 2023	6/10 (60%) eyes: AMT with amniotic fornix ring (AFR, polyactic acid, 3D printed); 4/10 (40%) eyes: standard AMT with sutures	Sutures (eyelids) with standard AMT; no sutures with AFR	Cryopreserved	Normal to moderate visual impairment; high rate of dry eye; moderate rate of conjunctival complications; low rates of eyelid and symblepharon.	Case series	Low

Study ID	AMT Surgical Technique	Use of Sutures/Glue	AMT Type	Outcomes Summary	Study Type	Risk of Bias
Agrawal et al. 2015	Sutureless AMT with symblepharon conformer	None	Fresh	Improved dry eye and conjunctival inflammation.	Case series	Moderate
Aziza et al. 2022	Unclear	Not reported	Not reported	One eye had normal BCVA; one eye had low vision.	Case series	Moderate
Honavar et al. 2000	Standard AMT with sutures and symblepharon ring	Sutures (eyelids)	Cryopreserved	Ocular surface repaired in 90% of eyes for improved pain and cosmetic appearance; best visual acuity was not recovered in chronic disease state.	Case series	Low
Jain et al. 2004	Partial AMT graft over symblepharon with sutures	Sutures (ocular surface)	Fresh	25% of patients had successful treatment of chronic symblepharon; recurrence of symblepharon in patients with comorbid chronic dry eye.	Case series	Moderate
Jain et al. 2008	AMT (patch graft)	Not reported	Not reported	Near normal BCVA; no chronic complications.	Case report	Moderate
Kheirikhah et al. 2008 #1	2/2 (100%) eyes: sutureless AMT with fibrin glue, 1/2 (50%) eyes: ProKera	Fibrin glue (ocular surface)	Cryopreserved	Near normal to moderate BCVA; improvement in chronic symptoms.	Case series	Low
Kheirikhah et al. 2008 #2	AMT for fornix reconstruction; 13/19 (68%) eyes: with sutures; 6/19 (32%) eyes: with fibrin glue	Sutures (palpebral conjunctiva) or fibrin glue (palpebral conjunctiva)	Cryopreserved	Variable BCVA; no recurrence in symblepharon.	Case series	Moderate
Konomi et al. 2013	Amniotic membrane graft with patch with sutures	Sutures	Cryopreserved	No improvement in LSCD.	Case series	Moderate
Mimouni et al. 2022	Sutureless AMT		Dehydrated	Moderate visual impairment; mild conjunctival complications.	Case series	Low
Prabhawat et al. 2000	Standard AMT with sutures	Sutures (eyelid)	Cryopreserved	Moderate visual impairment; mild conjunctival complications.	Case report within a case series	High
Solomon et al. 2002	Standard AMT with sutures	Sutures (eyelid)	Cryopreserved	Moderate to severe visual impairment; 50% rate of severe corneal complications.	Case series	Low
Solomon et al. 2003	AMT for fornix reconstruction with sutures	Sutures (eyelid)	Cryopreserved	Moderate visual impairment; 33% rate of symblepharon recurrence, conjunctival, and corneal complications.	Case series	Low

Table 1. Summary of Key Findings, Study Types, and Risk of Bias

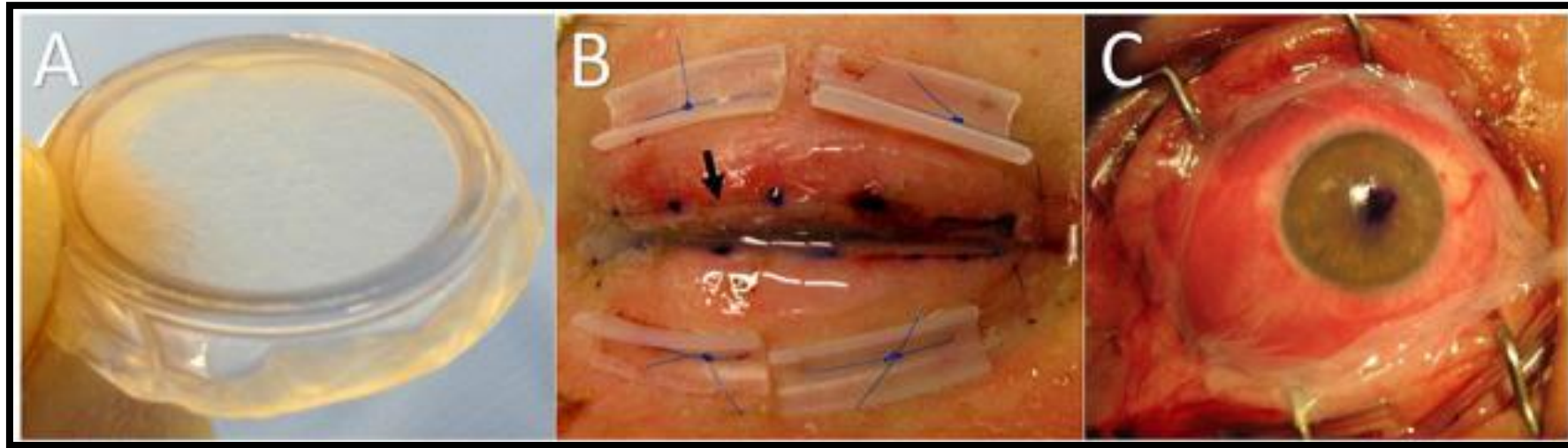


Image adapted from "USA: Ophthalmologic Evaluation and Management of Acute Stevens-Johnson Syndrome" by Darren Gregory, originally published in *Frontiers in Medicine*, and used under a CC BY 4.0 license.

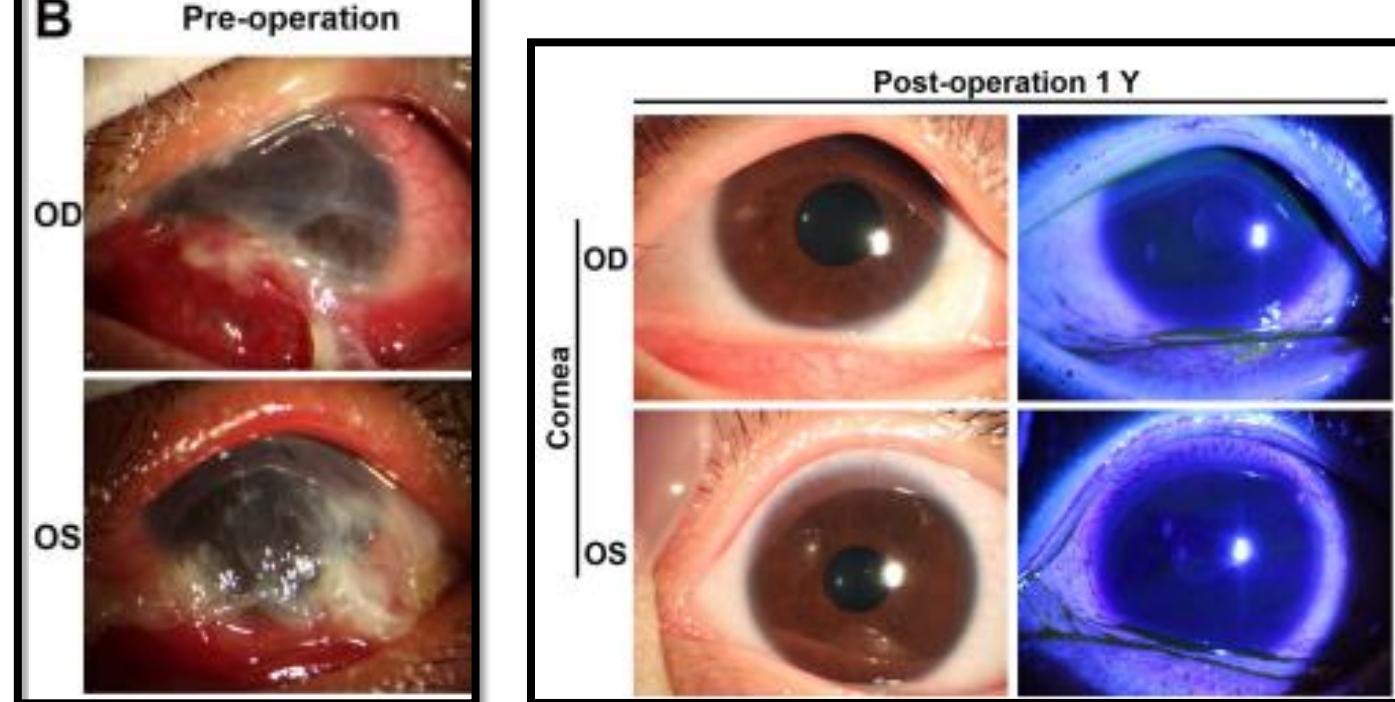


Figure 4. Pre- and post-operative results in an SJS patient treated with AMT using a 3D-printed Amniotic Fornix Ring (AFR). The AFR was used to replace sutures and hold the AM in place.⁶

Images adapted from "Novel technique for amniotic membrane transplantation for acute Stevens-Johnson syndrome/toxic epidermal necrolysis patients" by Zhang X, Geng X, Liu R, et al, originally published in *Heliyon*, and used under a CC BY 4.0 license.

Summary

- Best-corrected visual acuity (BCVA) at last follow-up was 20/50 or better for a majority of eyes in studies reporting BCVA → indicating that most patients who received AMT did not have chronic vision loss.
- AMT treatment resulted in low rates of long-term ocular sequelae commonly found in SJS/TEN patients, such as chronic dry eye; symblepharon; and abnormalities of the eyelids, conjunctiva, and cornea.
- The most common complications were chronic dry eye and lid margin keratinization.
- One randomized controlled trial demonstrated significantly lower rates of ocular sequelae in eyes treated with AMT compared with standard medical therapy.
- AMT applied in the acute phase of disease was associated with the most favorable outcomes.
- Standard AMT that covered the entire ocular surface, including the eyelid margins, resulted in fewer ocular complications (especially symblepharon and eyelid sequelae) when compared with ProKera, a lens-shaped amniotic membrane device.
- Standard AMT treatment uses sutures to hold the AM in place over the eyelids and ocular surface. Newer techniques that use symblepharon rings or cyanoacrylate or fibrin glue to secure the AM also result in favorable ocular outcomes.
- Sutureless techniques can be performed at the patient's bedside (rather than the OR), and the procedures are quicker, less invasive, and have a lower risk of pain, inflammation, bleeding, or infection.
- The most common type of AMT used in practice is cryopreserved; however, a few studies show that dehydrated AMT is also associated with successful outcomes.
- AMT has been found to be safe and successful in infants and children.

Conclusions

- Current literature overwhelmingly supports the use of AMT in the ophthalmic management of SJS/TEN patients, preferably with AMT covering the entire ocular surface in the acute phase, to improve long-term BCVA and to decrease the rates of chronic ocular sequelae.
- Most published literature on the use of AMT in SJS/TEN patients is in the form of case reports or case series due to the rarity of the disease, which limits statistical analysis.
- Larger studies that examine the benefits and long-term outcomes of sutureless techniques are necessary for further research.

References

- Pollard MC, Le LM, Dhaliwal DK. Stevens-Johnson syndrome. In: Sharma B, Titiyal JS, eds. *Corneal Emergencies*. Singapore: Springer; 2022. doi: 10.1007/978-981-16-5876-1_17.
- Singh P, Palit A, Gupta A, et al. Amniotic membrane grafting for acute ocular involvement in Stevens-Johnson syndrome: Review of perioperative considerations, surgical techniques, and outcomes. *Indian J Ophthalmol*. 2025;73(4):553-562. doi:10.4103/IJO.IJO_1238_24
- Sotomoto C, Ueta M. Updates on the ocular manifestations and treatment of SJS/TEN. *Allergol Int*. 2025;74(3):356-360. doi:10.1016/j.allit.2025.05.003
- Hopkinson A, Figueiredo FC. A Narrative Review of Amniotic Membrane Transplantation in Ocular Surface Repair: Unveiling the Immunoregulatory Pathways for Timely Intervention. *Ophthalmol Ther*. 2025;14(7):1385-1409. doi:10.1007/s40123-025-01143-w
- Gregory DG. USA: Ophthalmologic Evaluation and Management of Acute Stevens-Johnson Syndrome. *Front Med (Lausanne)*. 2021;8:670643. Published 2021 Jul 7. doi:10.3389/fmed.2021.670643
- Zhang N, Geng X, Liu R, et al. Novel technique for amniotic membrane transplantation for acute Stevens-Johnson syndrome/toxic epidermal necrolysis patients. *Heliyon*. 2023;9(8):e18853. Published 2023 Aug 7. doi:10.1016/j.heliyon.2023.e18853