

EFFICIENCY OF AMNIOTIC MEMBRANE TRANSPLANTATION IN THE MANAGEMENT OF LIMBAL STEM CELL DEFICIENCY

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Introduction

Limbal stem cells (LSC) have the function of regenerating corneal epithelial cells, as well as maintaining the integrity of the corneal epithelium. Various ocular pathologies can affect the limbal region, causing limbal stem cell dysfunction (LSCD). All cases of moderate to severe LSCD require surgical management. The main directions of its surgical treatment are: direct limbal tissue transplantation and ex vivo/in vivo expanded LSC transplantation. The amniotic membrane (AM), used alone or as a substrate for LSC, can be incorporated into LSC transplantation in almost all surgical approaches.

Keywords

Amniotic membrane, cornea, limbal stem cell deficiency, limbal graft

Purpose

To analyze the current data on applications of AM in the surgical management of limbal stem cell deficiency and to summarize the results of various surgical approaches.

Material and methods

A systematic search was performed on PubMed for papers published until February 2020, using combinations of the following search terms: "amniotic membrane", "limbal stem cell deficiency", "limbal transplantation", "conjunctival limbal auto-/allograft", "keratolimbal allograft". The data on AM preparation, as well as surgical techniques and clinical results was collected and analyzed.

Results

1. Isolated AM transplantation (AMT)

We selected 7 studies that reported results of isolated AMT in the treatment of partial LSCD (Table 1). Stable epithelial surface was maintained during a period of 12-25 months after surgery. Nonetheless, the success rate of AMT alone in patients with LSCD was only 31% at over a 50 months follow-up period.

Table 1. Outcomes of AMT alone in patients with LSCD

Year of publ.	Author	No of eyes	Mean age	Re-epith. (weeks)	Stable cornea (%)	Follow-up (months)
2015	Chugh JP	30	48.9	2	-	6
2013	Konomi K	16	57.4	1.5	31.2	52.3
2008	Kheirkhah A	11	32.4	2.5	72.7	14.2
2005	Lopez-Garcia JS	14	37	2	-	24
2005	Ivekovic R	5	31.6	3	60	18
2003	Gomes JA	4	34.5	3	-	17.5
2001	Anderson DF	17	42.3	2.5	58.8	25.8

2. Transplantation of limbal tissues combined with AM

A total of 15 studies were selected for the analysis of the outcome of CLAU or CLAL (Table 2). No notable difference was reported between CLAU and CLAU combined with AMT, but there was a greater re-epithelization time when AMT was used alone. AMT is being actively used as a common procedure in direct limbal tissue transplantation for its healing properties and to increase graft survival rate.

Table 2. Outcomes of AMT+CLAU/CLAL in patients with LSCD

Year of publ.	Author	No of eyes	Mean age	Re-epith. (weeks)	Stable cornea (%)	Follow-up (months)
2017	Arora R	10	18	2.5	90	6
2015	Moreira PB	28	40.3	4	-	24.8
2014	Barreiro TP	15	36.3	2	73.3	19.7
2012	Baradaran-Rafii	34	27.3	3.5	-	17.2
2012	Eberwein P	20	44	1.5	-	22.4
2011	Han ES	24	39.4	4	66.6	47.3

3. Transplantation of ex vivo expanded LSC on AM

A total of 23 studies were selected for the analysis of the outcome of CLET and COMET combined with AM substrate. The rejection rate of CLET was relatively low even when allogenic tissue was used, thanks to the small size of transplanted tissue, and the rate of success was stable even after one year. Similarly, the successful rate of COMET was stable two years after surgery.

Conclusions

Preliminary results of the application of AM in limbal transplantation show quite satisfactory data, but the lack of high-level studies, such as randomized controlled clinical trials, make it difficult to assess the comparative efficacy of AM transplantation in the surgical management of LSCD. And although studies have consistently reported favorable outcomes of different LSC transplantation techniques combined with AMT, it is unclear at the moment what is the role of the AM specifically and to what extent it impacts the final result.