

Collagen Sheets as a Biological Dressing in Burns

A Preliminary Report

R. N. Sinha, FRCS P. K. Varma, MS, MS (Pl. Surg.) P. Madan, MBBS

Deptt of Plastic Surgery, Burns & Maxillofacial, Patna Medical College & Hospitals, Patna

BURNS trauma is unlike any other condition in surgery. Through no fault of the surgeon or the patient, problems never cease, only different problems arise as time passes, and another dilemma mushrooms after one has been surmounted. One of the problems faced by the surgeons is to resurface the raw areas left after removal of eschars in deep burns. Sometimes there is no suitable donor area, or not enough skin, or possibility of homotransplantation is non-existent, or the general condition of the patient is so poor that skin grafting is not feasible. Under such circumstances, an easily available biological dressing is indicated.

In this study, collagen sheets have been tried as a biological dressing for burns wound.

Pending permanent resurfacing, it provides a temporary cover which prevents seeping of protein-rich fluid from the wound area and also prevents infection and possibly later sequelae of burns.

Collagen sheets are prepared from intestines of healthy and freshly slaughtered animals like sheep, goat, or cow have been found useful as a temporary skin cover for large burn wounds.

The raw material is thoroughly cleaned by washing in warm water and chemically

freed from the non-collagenous proteins, fats, mucopoly-saccharides etc. and finally processed into sheets.

The raw sheets prepared as described above get metabolised in the body within a short period of 2-4 days. To prolong the in-vivo time of digestion, the sheets are cross-linked with a suitable chromium salt like chromium-sulphate. The Cr₂ O₃ content of the chromicised sheets may vary between 0.5% to 2%.

The sheets so prepared are finally aseptically sealed in glass ampoules with a sterilizing fluid containing Ethylene-oxide.

The large raw wound possess a major problem in the management of burn. Under such circumstances, either a homograft or a biological dressing i.e. pigskin or lyophilised skin or a collagen sheet dressing is indicated. The collagen sheet appeared to afford excellent protective covering, thus enabling to diminish fluid loss and help maintain sterility of the raw area, and thus indirectly helping the patient to improve in general health. In some cases it has been found, specially when infection could be eliminated, and immobilisation assured, the collagen sheet is firmly attached to the raw area.

Collagen sheets have been found useful

as temporary skin cover. Where the raw area in cases of burn is much and the general condition of the patient low, in such cases no major procedure could be undertaken. Temporary cover by collagen sheets helped the patient much. Bacterial invasion or infection was checked, enabling skin graft to be done later on. The parts which were superficial, healed up. In deep burns eschar forms over the burnt area. The patient gradually goes into toxæmia unless these eschars are removed. Removal of the eschar when done, leaves a large raw wound. This is covered by collagen sheets. Escharectomy is a major procedure involving blood loss and sometimes, the infection under the eschar is also not completely removed, hence it may not be combined with skin grafting at the same stage. Temporary cover by collagen sheets enabled to check further oozing and prevent bacterial infection.

In spite of recent improvement in anti-bacterial substances, bacterial infection of the wound is still the most important and largely unsolved problem. The large raw area with its exudate of serum is like a large culture plate on which organism can multiply with impunity.

The raw area in the absence of skin cover was covered by collagen sheets thus minimising bacterial infection. Infection once it occurs can cause trouble in the following ways :

- (a) Local healing may be delayed.
- (b) Viable epithelial cells may be killed and a partial thickness burn may be converted into a full thickness burn.
- (c) Take of graft may be jeopardized.

- (d) Bacterial toxins may be absorbed.
- (e) Septicaemia may occur.

Hence collagen sheets combat bacterial infection and they enhance the healing process.

Conclusion :

Collagen sheets have been used as a temporary skin cover for burn wound. It has been useful in the following ways :

- (a) It provides a mechanical barrier to bacteria carrying particles from alighting on the wound—thus checking bacterial infection.
- (b) It checks fluid exudation and thus provides a dry surface.
- (c) Where donor area is limited, and there is shortage of good skin, it forms a good cover. In some cases it has been found, specially where infection could be eliminated and immobilisation assured, the collagen sheets remained firmly attached to the raw area, and in two cases no further cover was necessary.

It is hoped that collagen sheets, properly used (on proper granulating surfaces without infection and subsequently covered by pressure dressings to ensure immobilisation) will be one of the best and useful forms of skin cover. It is economical, availability is easy, does not involve costly procedures of preservation, and is easy to use.

There are no illeffects. In a country like India, where due to socio-economic conditions, leading to over-crowding, generally poor nutritional status in burns victims,

where autoskin grafting may not be immediately feasible, use of collagen sheets as a biological dressing has immense possibilities.

Acknowledgement

We are very grateful to Central Leather Research Institute at Madras in general and

Mr. Mahendra Kumar, Scientist of C.L.R.I., Madras for their gift of free supply of sterilised collagen sheets and provision of reference material.

We are indebted to the Superintendent, Patna Medical College Hospitals for use of hospital records for this paper.

REFERENCES

1. Abbenhaus, J. I., Robert, A MacMahon, Jans, G. Rosenkrantz and Bruce C. Paton. : Surgical Forum. American College of Surgeons, Vol. XVI, 1965.
2. Bromberg, B. : Plast. & Reconst. Surg., 36, 80, 1964.
3. Copenhagen, H. A. : Brit. J. Surg., 52 : 697-99, 1965.
4. Dunn, M. Mishihara et al : Science, 157:1329-30, 1967.
5. Hyashi, S. et al. : An application of artificial skin for full thickness burns. Research in Burns. E & S Livingstone (1966).
6. Samohyl, J., Chvapil, M. and Michalek, V. : Acta Chirurg. Orthoped. Traumatol. 36:352-357, 1969.
7. Wanke and Grozinger : Chem and Eng. News, 43:25-26, 1965.
8. Collagen Prosthesis, : J. Am. Leath. Chem. Assoc., 63 (8) Aug. 1968 p. 510, 1185 CN. 770568. Ethicon Inc. P. 3110. 67 A. 30-10-65, P.R.T.S. 3-11-64.
9. Synthetic skin ready to try on humans. : Chem. and Eng. News, 43, 40, 25-6, 1965. Via Coll. Curr., 6, 5, 6-313, 1965.
10. Treatise in Collagen : Vol. I. G. N. Ramachandran, Vol. II Gould. (Vols. 1 to 3) Academic Press.

Sl. No.	Name.	Reg. No.	Sex	Age. (Years.)	Condition of the recipient area.	Date of applying collagen sheet.	Ist. Dressing day.	Remarks.
1	M.K.	DPS/153	M	11	Patient in a toxic condition. Deep wound (burns) over the chest and both upper arms. Eschar excision and collagen sheet applications done under G.A.	26.8.71	Collagen sheet adherent to the wound in the upper arm. On the chest, granulation the collagen has not been taken up.	Wound remained healthy and showed granulation tissue. Required skin grafting later on. Patient survived. Satisfactory.
2	B	ERSP/194	M	18	Eschar excision of the abdomen and Rt. arm and application of collagen sheet done 7 days after burn. Infection.	30.10.71	Collagen sheet not taken up, wound healthy showing granulation tissue.	Partial take. Infection.
3	P.C.	ERSP/199	F	30	Eschar excision of the thigh and lower part of abdominal wall under General Anaesthesia and collagen sheet application.	12.11.71	Not taken, infection ++.	Not satisfactory.
4	"	"	"	"	Eschar excision and collagen sheet application on upper part of chest and rt. arm.	16.11.71		Died on 18.11.71. Infection +
5	L.B.	"	F	3	Healthy granulation tissue over sternal region. Rt. arm and Rt. flank. Collagen sheet application	20.9.71.	On the upper arm collagen sheet has been taken up.	Satisfactory. skin grafting done later on.

1	2	3	4	5	6	7	8	9
					done under heavy sedation.		Sloughed over the sternal region. Islands of epithelial tissue seen.	
6.	S.K.	ERSP/75	M	I	Healthy granulation tissue over the anterior part of Rt. leg and posterior portion of popliteal fossa.	4.4.72	All the collagen sheet remained intact but not adherent. Pyocyanous infection Dressings soaked with urine. Sheet on the leg taken well adherent, but that on the thigh again lost. Did not take. Dressings opened after one week. Infection—But sheet is present in its whole.	Unsatisfactory over the thigh region Infection ++ take over the leg very satisfactory. Satisfactory.
7.	"	"	"	"	The procedure was repeated again after 2 weeks when infection controlled. Repeated on the thigh again.			
8.	S.K.	ERSP/311	F	14	Applied on the patchy raw areas (as the donor site of a marsupial flap (and wall) where skin graft failed to take.	15.5.72		Satisfactory.
9.	M.T.	ERSP/29	M	69	Granulation tissue healthy over Rt. thigh and left leg.	30.5.72		
10.	U.D.	ERS/101	F	17	Collagen sheet applied on infected raw area on the posterior part of the left thigh.	30.5.72		