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Role of Collagen in Management of Chronic Non-Healing Wounds

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ABSTRACT

Background: A chronic wound does not heal in an orderly set of stages. The healing in such a wound is unpredictable in relation to time contrary to the way most wounds heal. The type of wounds that do not heal within three months are often and should be considered chronic wounds. **Aim**: To study the efficacy of topical use of collagen granules in wound healing. **Material and method:** In this prospective study one hundred cases with chronic non-healing wounds were selected and treated with collagen granules topically. The effect on the chronic wounds was studied for three months. The collagen granules were made from 100 % bovine collagen. **Observation and result**: all the wounds were observed for three months in terms of disappearance of slough, appearance of healthy granulation tissue and complete or incomplete healing**. Conclusion:** The use of collagen granules dressing accelerated the wound healing in chronic wounds/ulcers. In our study we found that the rate of wound healing was significantly better in using collagen granules.

Keywords: *Chronic non-healing wounds, chronic ulcers, collagen granules, normal saline.*

INTRODUCTION

In this millennium where mankind has succeeded in deciphering the human genetic code, the issue of chronic wound management still remains an enigmatic challenge. Chronic wounds, especially non-healing types, are one of the most common surgical conditions a surgeon comes across. From time immemorial doctors have been trying many methods to treat these types of wounds[7] (W Edwina et.al.).

The peculiarity of a chronic wound is that, whatever management you give, they refuse to heal, especially the pressure ulcers or bed sores[8] (David Brett et.al.). The notion that wounds should be kept dry, although still held by a considerable number of clinicians, is steadily losing ground. We now know that wounds re-epithelialize much faster when treated with dressings which allow moist wound healing. We recognise that occluding wound does not lead to infection. Even though many modalities of wound care have come up to assist a surgeon, like the use of compression bandages to treat venous ulcers, the problem of chronic wounds still remains. Chronic wounds are a health problem of enormous magnitude affecting many hundreds of thousands of patients.

A wound care revolution is currently in the making. Many techniques have been tried over the centuries to heal chronic wounds. Although wound dressings have been used for at least two millennia, there exists no ideal dressing.

Surgical dressing of both open and closed wound is based mainly on tradition, training and the surgeons own philosophy. During the last two decades a wide variety of innovative dressings have been introduced. Recent studies have shown that application of collagen based dressings has got an important role in assisting wound healing[9] (Ashok Damir et.al.). Collagen is the major fibrous proteins of extracellular connective tissue and it is also the most ubiquitous and plentiful proteins in the animal kingdom[4] (Arvindan Rangraj et.al). The word collagen is derived from Greek word KOLA (Glue) Plus gene. They are the most abundant types of proteins in the

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human body comprising 25% of the total body proteins and 70% to 80% of skin (Dry Weight).Proteins are natural polymers and make up almost15% of the human body and are essential for the process of wound healing. The building blocks of all proteins of amino acids.

Use of collagen for wound healing has drawn tremendous interest from the scientists in the past few decades as it claims to help in healing wounds[6](Karunakar Reddy et.al). Thus a need is felt to study the effectiveness of collagen dressing in management of chronic non-healing wounds.

Aims and Objectives

To assess wound healing in Patients who underwent collagen dressing on the basis of following factors.

*complete healing or Non-Healing

*Duration of Wound healing

*Any adverse reaction due to collagen dressing

*Quality of wound healing.

MATERIAL AND METHOD

The study has been conducted in Department of general surgery, Sharda hospital, Knowledge Park II-III, Greater Noida, UP-201306 during period May2015-June2016.A written informed consent was taken from the patients inducted in to the study. A copy of patient information sheet was also given to the patient, and ethical clearance was taken.

STUDY DESIGN: this is a prospective study. A total of 100 patients were included in the study.

Inclusion criteria: Patients from Greater Noida of all age group from both urban and rural population having a chronic non-healing wound, one or more chronic non-Healing wound, Diabetic ulcers, Those wounds which are expected to heal in long time except malignant wounds, venous ulcers and arterial ulcers were included in the study.

The Acute wounds, patients having allergy to dressing constituents and malignant wounds were excluded from the study.

Methodology: The patients in the study group were subjected to daily collagen based wound dressing. The product contained spherical designed particles that consist of 100 per cent bovine native collagen.

Methodology used for Application

Removal and disposal of wound dressing than wound was irrigated with sterile water or saline until free of debris, than collagen particles were applied to cover the wound surface. In minimally draining wounds the collagen particles were lightly sprinkled just enough to cover the surface of the wound bed. In the significantly draining wounds wound surface was covered with collagen particles ¼ to 1/8 inches deep. The wound was secondarily covered with a Non-Adherent, absorbent dressing. Efforts were made to maintain a moist wound environment, saline soaked gauze piece was used as required. The wound was evaluated on weekly basis.

Observation and Result

Total 100 number of patients were included in the study. A randomized control trial was conducted by randomly allocating patients to the study.

Distribution according to Age:

30% of patients were in 4th decade of life. The 40-60 years of age group accounted for over 50% of cases. The youngest patient was of 17 years of age and the oldest patient was of 70 years.

Distribution of gender among study

The male to female ratio is 1.7:1

Rural and Urban distribution among study

The majority of patients belonged to the rural background.

Table-1: Aetiological distribution

Aetiology	No. Of cases	Percentage
Diabetic	32	32%
Venous	31	31%
Arterial	3	3%
Tropic	18	18%
Tubercular	2	2%
Traumatic	14	14%

The diabetic and venous ulcers were the most common among other causes accounting for almost a third of the cases each. Tuberculosis was the rarest cause of chronic non-healing wound.

Table-2: Age and Sex wise distribution of Aetiology

Age Group (Years)	Cases	Diabetic M/F	Venous M/F	Arterial M/F	Trophic M/F	Tubercular M/F	Traumatic M/F
0-10	-	-	-	-	-	-	-
11-20	3	-	1/0	-	-	1/0	1/0
21-30	11	0/1	1/3	-	0/1	0/1	3/1
31-40	17	5/0	1/2	2/0	2/1	-	4/0
41-50	30	10/5	3/5	1/0	1/0	-	3/2
51-60	28	9/0	6/6	-	4/3	-	-
61-70	11	2/0	0/3	-	3/3	-	-
Total	100	26/6	12/9	3/0	10/8	1/1	11/3

More than 50% cases accounts 40-60 years age group. Only 3% cases occurred in the first two decades of life. Venous ulcer was the commonest cause of chronic non-healing wound in the females whereas diabetic ulcers were most frequent in men. Neuropathic ulcers were almost equally frequent in either sex and traumatic ulcers were more commonly seen in males.

Table-3: Risk Factors

Risk Factors	No. Of patients
Smoking	48
Previous DVT	15
Obesity	20
Oral contraceptive intake	4
Diabetes Mellitus	42
Peripheral Vascular disease	3

The smoking was the most prevalent risk factor among all cases followed by diabetes mellitus.

Site of Wound

The maximum number of cases had ulcers on the planter aspect of the foot accounting for 41% of cases. Most of them were diabetic (25%) or trophic (7%). venous ulcers were more common over the medial malleolus and surrounding area. Trophic ulcers were also commonly seen at ischial and sacral regions.

Table-4: Complication of the Wound State

Complications	No.of Cases	Percentage
Gangrene	5	5
Sloughing and Exposure of tendon	11	11
Eczema and Irritant Dermatitis	19	19
Bony Changes(Periostitis,osteoporosis, Osteomyelitis)	2	2
Contracture	1	1
Haemorrhage	1	1
Subcutaneous calcification	3	3
No Complications	58	58

The eczema and irritant dermatitis were the most commonly encountered complications in 19 cases followed by sloughing and exposure of tendon in 11 cases and gangrene was seen in 5 cases. Significant Haemorrhage occurred in a case of venous ulceration requiring admission and resuscitation. Bony changes

occurred in 2 patients causing prolonged morbidity.

Table-5: Commonly isolated organisms from wound

S.No.	Organisms	No. of Cases	Percentage
1	Staphylococcus Aureus	68	68%
2	Streptococcus Pyogenes	14	14%
3	Escherichia coli	17	17%
4	Klebsiella	5	5%
5	Proteus mirabilis	15	15%
6	Others	26	26%
7	Sterile	25	25%

75 out of 100 cases were positive for various organisms during routine pus culture. Staphylococcus Aureus was the most frequently isolated organism (68%) followed by E.coli (17%) and Proteus species (15%).In many wounds more than one organism was isolated. No organism could be isolated in 25 cases.

Table-6: Disappearance of slough, Appearance of healthy granulation tissue & complete Healing

Aetiology	No.of Cases	Disappearance Of Slough			Appearance Of Healthy granulation Tissue			Complete Healing		
		<1WK	1-2WK	>2WK	<2WK	2-3WK	>3wk	<4wk	4-6wk	>6wk
Diabetic Ulcers	32	2	20	7	2	18	9	2	19	6
Venous Ulcers	31	3	21	7	3	16	12	3	19	4
Arterial Ulcers	3	-	1	-	-	1	-	-	1	-
Trophic Ulcers	18	2	5	9	2	5	9	2	1	7
Tubercular Ulcers	2	-	2	-	-	2	-	-	1	1
Traumatic Ulcers	14	7	7	-	7	7	-	7	6	1
Total	100	14	56	23	14	49	30	14	47	19

It is evident from the table above that for disappearance of slough it took less than one week in 14 patients while it took 1-2 weeks in 56 patients but in 25 patients it took more than 2 weeks for disappearance of slough. For the appearance of healthy granulation tissue it took less than 2 weeks in 14 cases while it took 2-3 weeks in 49 patients but in 30 Patients it took more than 3 weeks before healthy granulation tissue appeared. In 5 Patients amputation had to be done because of development of gangrene .In 2 patients (one diabetic

and another trophic ulcer) continued to have slough and infection. They developed osteomyelitis and underwent amputation.

For complete healing it took less than four weeks in 14 patients while in 47 patients it took around 46 weeks for complete healing and in 19 Patients it took more than 6 weeks for complete healing with conservative management.

One Patient with traumatic ulcer at posterolateral aspect of left knee achieved complete healing but developed contracture for which contracture release with skin grafting has to be done.13 patients failed to achieve complete healing despite development of healthy granulation tissue. In these Patients skin cover had to be provided in the form of skin grafting or flap. Overall in 21 cases some sort of surgical intervention like amputation, skin grafting or flap was required to achieve complete healing.

No adverse reaction with collagen was seen in any of the cases and the quality of the wound healing was good in all the cases managed with collagen based wound dressing.

Treatment of wound

Thus a total of 79 Patients were conservatively managed using collagen based wound dressings and other modalities required for the management of primary cause whereas 21 cases required some form of surgical intervention for the healing of ulcer.

DISCUSSION

Wound dressings have evolved from the status of providing physical protection to the raw surface, absorbing local exudates and controlling local infection by local medications to the level of providing adequate environment promoting wound healing. This has been achieved by modern wound dressing technique by promoting granulation tissue formation. Concept of moist wound dressing which came into vogue in 1960's revolutionised wound care. This led to further research in this direction leading to influx of many products like semi-permeable plastic film dressings, Hydrocolloids, Hydrogels etc. In the wound care scenario, each claiming a better wound healing rate than the others. As the concept of outcome based medicine evolved, the need for a better wound dressing modality became more acute.

All the Patients with chronic non-healing wound were subjected to daily collagen based wound dressings and other modalities of management required for underlying cause of chronicity and the wound was evaluated weekly. Evaluation of the role of collagen in management of chronic Non-healing wounds was made in terms of complete healing or Non-healing, duration of wound healing, any adverse reaction due to collagen dressing & quality of wound healing.

In the study for disappearance of the slough it took < 1 week in 14 patients while it took 1-2 weeks in 56 patients but in 25 Patients it took more than 2 weeks for disappearance of slough. For the Appearance of healthy granulation tissue it took < than 2 weeks in 14 cases while it took 2-3 weeks in 49 Patients but in 30 Patients it took more than 3 weeks before healthy granulation tissue appeared. In 5 Patients amputation has to be done because of development of gangrene. In 2 Patients (1 diabetic and another trophic ulcer) continued to have slough with Infection. They developed osteomyelitis and underwent amputation. For complete healing, it took < 4 weeks in 14 patients while in 47 Patients it took around 4-6 weeks. In 19 Patients it took less than 6 weeks for complete healing with conservative management. One Patient with Traumatic ulcer at posterolateral aspect of Knee achieved complete healing but developed contracture for which contracture release with skin grafting has to be done. 13 Patients failed to achieve complete healing despite development of healthy granulation tissue. In these Patients skin grafting or flap was required. In 21 cases surgical intervention like amputation, skin grafting or flap was required for complete healing.

Veves A,et al[1] studied a total of 276 cases of diabetic foot ulcers from 11 centres and reported that more wounds achieved complete healing with promogran(a collagen /oxidised regenerated cellulose dressing) treatment, especially in wounds <6 months duration in comparison to standard treatment. The result in our study are comparable to this report.

Vin F, et al [2] studied a total of 73 Patients of Venous ulcers and reported that Promogarn accelerated healing in venous leg ulcers with 20% more wound healing improved. A significant reduction in wound area was achieved with Promogran over Non-Adherent dressings

and compression alone. The result in our study are comparable.

Nisi G, at al[3] studied a total of 80 patients of Pressure sores and reported that more wounds achieved complete healing with Promogran (90% to 70%), within shorter healing times and proved more cost effective. The results in our Study is comparable.

In our study no adverse reaction to collagen was seen in any of the cases and the quality of the wound healing was good.

CONCLUSION

*Disappearance of slough took place in <1 week in 14% of cases ,in 1-2 weeks in 56% cases and in 23 % cases it did not take place even after 2 weeks.

*Healthy granulation tissue appeared in < 2 weeks in 14% cases, in 2-3 weeks in 49 % cases while in 30% cases it did not appear even after 3 weeks.

*Complete healing took place in 14% cases in < 4 weeks, in 47% cases it took around 4-6 weeks, in 19% cases it took 6 weeks with conservative management, and in 21% cases some surgical intervention was required.

*No adverse reaction was observed with collagen in any of the cases.

*The quality of wound healing was good in all of the cases.

*Collagen based wound dressings are cost effective as they significantly reduce time of healing.

*Collagen based dressings are user friendly and requires only a cover dressing.

*Collagen based dressings are indicated in almost all types of wounds.

Conflict of Interest: None.

Source of Support: None declared.

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