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Original Research Article

A Comparative Study of Wound Healing in Rats within Wooden and Metallic Pyramid Models

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ABSTRACT

Introduction: "Wound healing" can be defined as replacement of destroyed tissue by living tissue. The injured tissues are usually replaced by collagen tissue. Wound healing is not an isolated, single phenomenon; but it is a product of the integrated response of several cell types to injury – the end result of which is preservation of life. the present work was done to find out whether wound healing within a "Pyramid Space" is influenced by the material from which the pyramid is made of – by comparing the "wound healing" process in rats within a wooden and metallic (aluminum) pyramid models.
Materials and methods: Two pyramid models were used – one of which was made from wood and the other from metal (aluminium) – both of them having same dimensions. The rats kept within the wooden pyramid acted as "control group" and those kept within the metal pyramid as "test group". Incisional wounds were generated and breaking strength of wound was estimated by continuous, constant water flow technique.
Results: Both the groups showed a healthy and abundant granulation tissue, containing numerous capillaries and fusiform fibroblasts. The control animals showed the breaking strength of 381.3 ± 74.1g in the 10 day old incision wound. The "Test Group" animals showed a breaking strength of 376.7 ± 88.1g in the 10 day old wound (p>0.05).
Conclusion: This study shows that use of metal pyramid model doesn't have any additional benefit in wound healing process – when compared to wooden pyramid model.

Key words: wound healing, pyramid breaking strength

INTRODUCTION

"Wound" is defined as disruption of anatomic or functional continuity of living tissue. Wounds are caused by trauma – either accidental or surgical, physical, chemical, microbial, immunological insult to the tissues or ischemia, which leads to cell death. [1] "Wound healing" can be defined as replacement of destroyed tissue by living tissue. The injured tissues are usually replaced by collagen tissue. Wound healing is not an isolated, single phenomenon; but it is a product of the integrated response of several cell types to injury – the end result of which is preservation of life. An unhealed wound, sooner or later, will result in the death of the organism. [1] Treatment is therefore aimed at either shortening the time required for healing or minimizing the undesired consequences. Over the years many remedies have been experimented to facilitate and hasten normal healing.

No other manmade object has claimed man's attention and wonderment as the Great Pyramid at Gizeh. It has always been the scene of mysterious events and strange happenings. It has been discovered that the shape of the pyramid, with the dimensions proportionate to that of the Great Pyramid at Gizeh and centered on the true North-South axis, has unusual energy field or powers. There is a relation between the shape of the space inside the pyramid and the physical, chemical and biological process going on inside that space. [2] There are reports which show that persons who sat inside the pyramid model for several hours, felt relaxed, plant growth was better and shelf life of vegetables prolonged. Also, one of the most recent studies, done by Dr. B.G. Subba Rao (1996) suggests that "wound healing is better within a wooden pyramid model". [3] Based on this report, the present work was done to find out whether wound healing within a "Pyramid Space" is influenced by the material from which the pyramid is made of – by comparing the "wound healing" process in rats within a wooden and metallic (aluminum) pyramid models.

MATERIALS AND METHODS

Construction of Pyramid Models:

Two pyramid models were used – one of which was made from wood (fig. 1) and the other from metal (aluminium) (fig. 2) – both of them having same dimensions, with a base 28.25^{II} side 26.9^{II} and vertical height of 18.0^{II} (fig. 3). The dimensions of these pyramid models are proportionate to that of Great Pyramid at Gizeh. One way to determine the correct dimensions for the pyramid is - for every one foot of height 1.57 feet of base was required and 1.49 feet of side. [2] The base was not fixed to the pyramid so as to allow the feeding of rats. A small window was created on one of its face with a sliding glass piece for observation. Ventilatory holes were provided on all the four faces. Using a mariner's compass, one of the diagonals was aligned north-south along the magnetic axis of the earth.

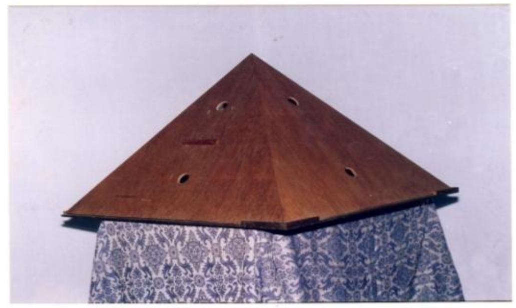

Photo No. 1: Wooden Pyramid

Photo No. 2: Metal Pyramid

Animals:

The study consisted a "control group" and a "test group". The rats kept within the wooden pyramid acted as "control group" and those kept within the metal pyramid as "test group". Healthy albino rats of Wistar strain weighing between 150-200gms, 10 each as "control" and "study" groups. Rats showing infection were excluded from the study.

Experimental procedure:

Rats were lightly anaesthetized using ether. The hair was shaved from their backs, and the skin was carefully cleansed with spirit. A I^{II} paramedian straight incision (1cm lateral to the vertebral column) was made with a scalpel through the entire thickness of skin of the back. A standardized wound was made possible using geometric compass for marking the points I^{II} apart. After mopping the wounds dry, wound were closed with intermittent sutures using nylon threads. Wounds were again mopped with cotton swabs soaked in spirit. Wounds were not dressed and no antibiotic was used. The procedure was done for both the groups. The rats were kept in the pyramids (one at a time). The pyramids were then kept in a well ventilated room. The rats were maintained on adequate animal chow (rat and mice feed – Pranav Agro Industries Ltd. Sangli;I) and water ad libitum.

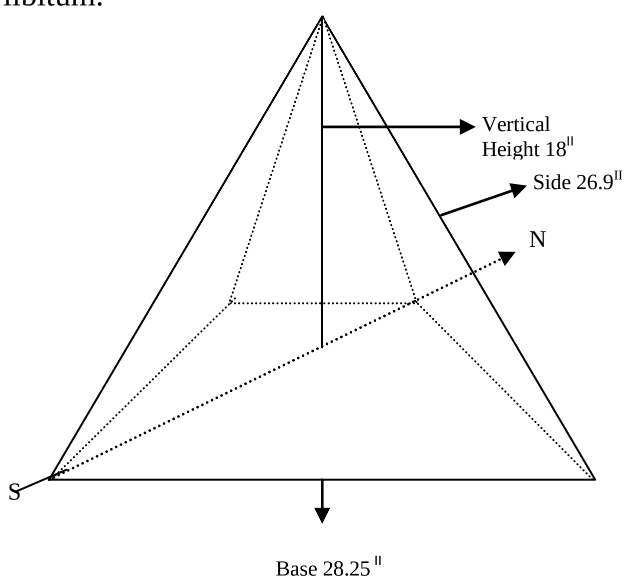

Fig. 3: Pyramid Model

Assessment of wound healing:

Breaking strength of wound:

On 10^{th} post wound day, light ether anaesthesia was given, sutures were removal carefully. The breaking strength of wound was estimated by continuous, constant water flow technique as described by Lee (1968).[4] Four readings were taken for a given incision wound. The average was taken as the individual value of breaking strength. Mean value for ten rats gives breaking strength for a given group. This was done both for "control group" as well as "Test group".

Histological examination of the wound:

Under aseptic precautions, a small portion of the wound along with its floor was excised from both the groups. The fixation of the tissue was done with 10% formalin and then subjected for processing. The specimens are then cut on a microtome into sections of 10μm (micron) thickness. Staining was done using Haematoxylin and Eosin (routine) and observed under low and high power microscope.

Total leukocyte count (TLC) and Differential Leukocyte count (DLC):

A sample of blood is obtained by amputation of the tip of the tail. Total count was done using standard procedure i.e. using W.B.C. pipette, Turk's fluid and improved Neubauer chamber. DLC was done by staining the prepared blood smear with Leishman's stain.

RESULTS

Breaking strength of wound:

The control animals showed the breaking strength of 381.3 ± 74.1g in the 10 day old incision wound. The "Test Group" animals showed a breaking strength of 376.7 ± 88.1g in the 10 day old wound. [fig 4]. On application of 'p'-test, the difference was not found to be statistically significant. $P < 0.05$ is considered significant.

TLC:

The TLC showed a hike from 7,065/cumm ± 3,136 (on day '0') to 8,775/cu.mm ± 2886 (on 10^{th} day) in the control group. It was highly significant ($P < 0.05$). In case of "Test group" also there was a hike from 6,270/mm^3 ± 1851 (on "0" day) to 8535/mm^3 ± 2890 (on 10^{th} day). It was also highly significant ($P<0.05$) (fig. 5). But the difference (1^{st} to 10^{th} day) between two groups was not significant ($P>0.05$).

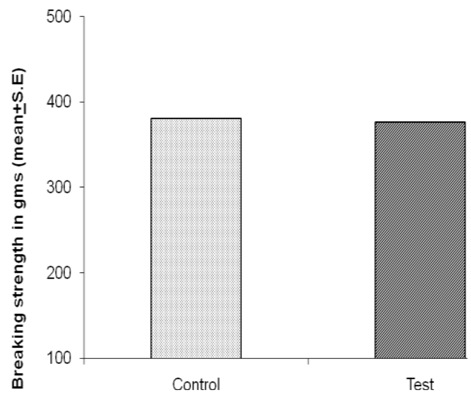

Fig. 4 Effect of pyramid models on breaking strength of 10 day old incision wounds.

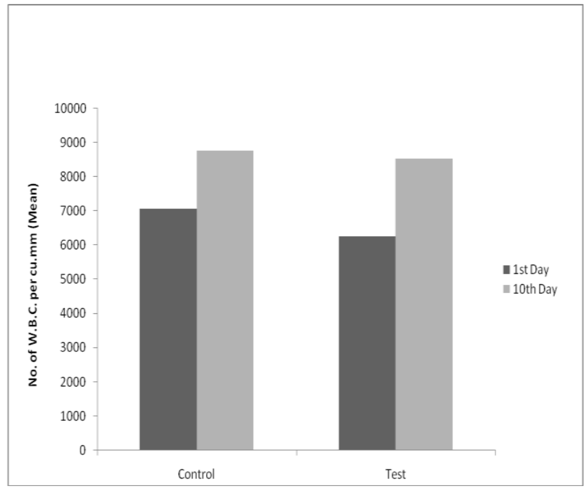

Fig 5. Effect of the pyramid models on the TLC

Table 1. Changes in DLC in control and test group on 1st day and on 10th day.

Control	**Cells**	**1st Day (%)**	**10th day (%)**
	N	20.2	16.0
	E	1.7	1.0
	B	0.2	0.1
	L	73.0	78.0
	M	4.9	4.9

Test	**Cells**	**1st day (%)**	**10th day (%)**
	N	21.8	16.6
	E	2.2	1.0
	B	0.1	0.1
	L	70.3	75.6
	M	5.7	6.7

N=Neutrophils B=Basophils
E=Eosinophils L=Lymphocytes
M=Monocytes

DLC:

The table no. I show the changes in DLC in control and test group on 1st day and on 10th day. Normally, in rats, lymphocytes form the major percentage of leukocytes. [3, 5] In both the groups the lymphocyte % is raised (from 1st to 10th day), which is significant (P<0.05). But when we compare the difference (1st to 10th day) between two groups, it is not significant (P>0.05). In both the groups the neutrophil % is reduced (from 1st to 10th day), which is significant (P<0.05); But when we compare the difference (1st to 10th day) between two groups it is not significant (P>0.05). Eosinophils % is reduced from 1st to 10th day in both the groups, but it is not significant and the difference between two groups is also not significant. Monocytes and basophiles don't show significant alterations in their population from 1st to 10th day and also the difference between two groups is not significant.

The histological pictures of the wounds after 10 days:

Both the groups showed a healthy and abundant granulation tissue, containing numerous capillaries and fusiform fibroblasts (fig 6 & 7). The infiltrating mononuclear inflammatory cells were very few in number. Intervening, well organized, high amount of collagen fibre bundles were also seen in the dermis. Epithelialization was occurred and was shown to bridge the incised wound surfaces. When we compared both the groups, there was no significant difference in the histological picture with regard to collagen fibre content, fibroblast number, inflammatory cell population, capillaries and epithelialization.

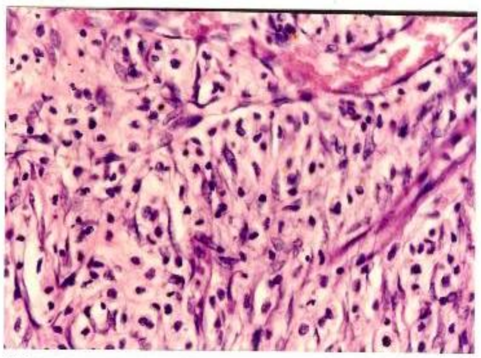

Fig 6 : Area showing granulation tissue with interspersed collagen and fusiform fibroblasts (Control group). Haematoxylin & Eosin (routine stain) x 200

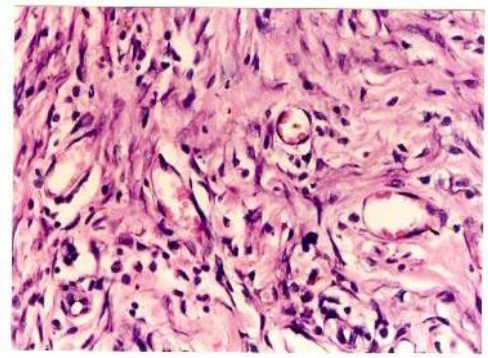

Fig 7 : Area showing granulation tissue with interspersed collagen and fusiform fibroblasts (Test group). Haematoxylin & Eosin (routine stain) x 200

DISCUSSION:

"Wound healing" has been a long neglected area within medicine over the past several years, renewed interest in the field has been generated. [6] Cutaneous wound healing involves the complex interaction between many cell types, their cytokines or mediators and the extracellular matrix. The process of healing may proceed in a timely or an untimely (slow) fashion. These are conveniently called acuteor chronic wounds. Obviously, cutaneous wound healing is of major importance in its own right, but it may also provide a model for understanding the repair processes occurring in organs other than the skin. [6]

Over the years many remedies have been experimented to facilitate and hasten normal healing. The present work was undertaken to see whether the wound healing is better in a metallic (aluminium) pyramid model when compared to a wooden pyramid model. The basis for carrying out the work was a report that "wound healing is better in a wooden pyramid model". Our study shows that use of metal pyramid model doesn't have any additional benefit in wound healing process – when compared to wooden pyramid model i.e there is no significant difference in wound healing process within a wooden (control) and metallic (Test) pyramid models, and so it appears that the quality of the material from which pyramid is constructed is immaterial as far as the wound healing is concerned.

However it was certain from the photomicrographs of the wound tissue that epithelization was complete. Fusiform fibroblasts and collagen bundles were in plenty. Even though there was significant increase in the total leukocyte count from 1st to 10th day both in control as well as test group – the difference between these two groups was not significant. This shows that the chances of wound getting infected is equal in wooden and metal pyramid models – provided, the other factors contributing for infection remain unaltered. However, since the present study consisted of a small sample (of 10 sets of rats only), further study with a larger sample may throw more light in this regard.

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