Chapter 1

INTRODUCTION

Wound healing is a complex and dynamic process of attempting to restore cellular structures and function. It consists of an orderly and timely reparative process of events that results in sustained restoration of the anatomic and functional integrity of the damaged tissue. The initial wound touches off a series of programmed, separate yet, interdependent responses to the injury, including inflammation, epithelization, angiogenesis, fibroplasias, contraction, epithelization and remodeling. Due to several reasons, many wounds fail to heal. Some of the factors that interfere with wound healing are infection, old age, malnutrition, smoking or alcohol consumption, underlying disorder, medication, repeated trauma, site of the wound in body and patient compliance.

Wound colonization is most frequently polymicrobial involving numerous microorganisms that are potentially pathogenic; any wound is at some risk of becoming infected. In the event of wound infection wounds fail to heal. Widespread opinion among wound care practitioners is that aerobic or facultative pathogens (gram-positive cocci e.g. *Staphylococcus aureus, Streptococci*, gram-negative bacilli e.g. *Pseudomonas aeruginosa, Escherichia coli, Klebsiella pneumonia*) and anaerobic bacteria (*Bacteroides, Prevotella, Porphyromonas, and Peptostreptococcus spp.*) are responsible for wound infection. Various researchers studied polymicrobial wound colonization in different types of wounds.

Attempts have been made to accelerate the wound healing either when it is progressing normally or when healing is suppressed by various agents. Wound healing studies mainly aim to detect the various means and factors influencing the healing process, so that they could be either used or avoided in clinical practice to favorably alter the healing process.
Certain well established principles are followed in wound care like debridement and cleansing, maintenance of a moist environment, providing materials for healing, prevention of further injury along with local and systemic antibiotics. The widespread use of antimicrobials agents in the management of wound infection has led to major concern of MDR (multi drug resistant) microorganisms. Controversy still exists about the usefulness of topical antiseptics/ antimicrobials like iodine, hydrogen peroxide, silver preparations even though reduces the bacterial burden but may have side effects. Vacuum assisted wound closure (VAC) is among the recent trends in wound care. VAC is the practice of exposing wound to a sub atmospheric pressure for an extended period to promote debridement and healing it was first described by Fleischmann et al in 1993. Wanner MB et al successfully used this in 15 patients with open fractures and reported that the treatment resulted in efficient cleaning and conditioning of the wound, with marked proliferation of granulation tissue and reduced the cost and the hospital stay. Later intermittent negative pressure combined with moist wound healing principle was developed and incorporated in Limited Access Dressing (LAD). LAD basically utilizes a transparent plastic material to isolate wound environment with provision of additional port/ ports to manipulate wound environment more effectively. The Limited Access Dressing is a combination of intermittent negative pressure (for 30 minutes) and a moist wound dressing (for 31/2 hours without negative pressure) that is covered with a transparent polythene material (a total of 21 hours moist dressing and 3 hours negative pressure dressing in a 24- hour period). Negative pressure (up to -30 mmHg) is applied through naso gastric tube connected to a suction machine that is then placed under a polythene wound cover. Various designs (Types I, IB and II) have been developed to suit different types of wounds.

The material that contacts the wound LAD is classified into 2 groups:

A. Hydrocolloid material contacts the wound (LAD I)
B. Polythene sheet contacts the wound (LAD IB and LAD II)

Two problems associated with LAD I are liquefied hydrocolloid materials blocking the tube, and poor wound floor visibility for the initial few days until the suction removes any liquefied material. To avoid doubts and problems associated with LAD I, in LAD
IB a sterile polythene sheet separates the wound along with tubes from hydrocolloid and in the Hydrocoll® (Hartmann, Germany) a central hole is made to improve visibility. LAD I and LAD IB is used for smaller wounds (up to 10 cm x 10 cm given that the maximum size of Hydrocoll was 15 cm x 15 cm). In LAD II wounds are covered with larger polythene sheets along with tubes (as in other LAD designs) and then sealing is achieved with pieces of Hydrocoll and the adhesive polyurethane film (OpSite™, Smith & Nephew). This retains all the advantages of available dressing methods with additional advantages of better wound care, controlling hospital acquired infection and leech effect.

Various physical therapy modalities are used in accelerating the wound healing. Among them popularly known are pulsed electrical stimulation, ultrasound, low level laser therapy, ultraviolet rays, hyperbaric oxygen therapy, thermal and non thermal diathermy. Ultraviolet rays (UVR) produce direct photochemical reactions when it interacts with the body. Well accepted facts of ultraviolet rays are its bactericidal effect and enhanced growth of epithelial cells which are used in the treatment of chronic infected wounds. UVR produces intra–strand cyclobutane–type pyrimidine dimers in Deoxyribonucleic acid (DNA). These and other photoproducts can be lethal and ultimate fate of irradiated cells depends upon the ability of the cells to repair the UV induced damage. The rays most effective in producing this result have been found to lie between 250-270nm. Bactericidal effect of ultraviolet rays was studied in different situations like in-vitro, postoperative exit site infection and in the management of pressure ulcers. The different organisms studied were Staphylococci, Escherichia coli, Streptococcus pyogenes, Pseudomonas aeruginosa and fungal strains by different researchers.

Exposure of UVR a non ionizing type of radiation accelerates the rate of healing and causes reduction in the depth of the wound by an increase in the granulating tissue. In LAD since the plastic is transparent to light it may be logical to use beneficial effects of radiant energy (ultraviolet rays) through the LAD. Also the increase in the multi antibiotic resistance of bacteria in recent years and understanding the benefits of both LAD and UVR on bacterial growth, we intend to combine both and study the effect on
wound healing with or without plastic cover. In the currently available methods of occlusive dressings the LAD has the advantage of being transparent. The present study was undertaken to assess the effect of UVR in both in-vitro and in-vivo experimental method using albino Wistar rats.