

## Role of Pressure Therapy in Scar Management

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### Abstract

Scars are a natural part of dermal healing process and they consist of fibrous collagen tissue, laid down in response to dermis. In abnormal scarring excessive collagen is produced and causes the formation of abnormal raised scars known as keloid and hypertrophic scars. Scars can have many significant functional, cosmetic and psychological sequelae. Despite the development of number of treatment modalities, no definitive therapy has been established. In this case report, author presents the experience of using pressure garment therapy in management of abnormal scars.

**Keywords:** Abnormal scar; Pressure therapy; Vancouver scale.

### Introduction

Scars are a natural part of dermal healing process and they consist of fibrous collagen tissue, laid down in response to dermis. In abnormal scarring excessive collagen is produced and causes the formation of abnormal raised scars known as keloid and hypertrophic scars.

### Materials and Methods

The study was carried out in a tertiary care hospital in South India, after receiving approval from institutional ethical council. The patient was a 40-year-old male presented with history of raw

area over the right leg and foot for the last 90 days, which was developed after sustaining an abrasion over the back of right ankle, which progressed to swelling. He had history of application of kerosene over the right leg and foot for unbearable pain, which progressed to extension of swelling and bleb formation till knee. He was known case of diabetic for 1 year and defaulted medication. He went to nearby hospital, where they did fasciotomy and debridement over the swelling of right leg and foot. He came to JIPMER for further management. He under went 4 sessions of hydrojet debridement + prolotherapy + insulin therapy + LLLT + APRP + heterografting + RONPWT, twice split skin grafting. There is no residual raw area. Abnormal

scar (figure 1) has been formed which was treated with pressure therapy. Then the response was assessed by Vancouver scar score.



Fig. 1: Scar in the right leg before pressure therapy.

## Result

After using pressure garment (figure 2) over the scar area for 2 weeks it has been noticed that there was significant reduction in the size of the scar. Initial assessment of scar by VSS score was 10/13 and after scar management, the score was 8/13 (figure 3, 4).



Fig. 2: Pressure Therapy.



Fig. 3-4: Improved scar in right leg post pressure therapy.

## Discussion

Since the early 1970s, pressure garment therapy has been used to treat burn scars, with many studies reporting reduced height, increased pliability, and improved clinical appearance of scars.<sup>1-4</sup> Pressure garment therapy application at any time point reduced total scar thickness. A correlation between scar biomechanics and scar height was observed previously, with thinner scars exhibiting greater pliability.<sup>5</sup>

In previous case-control study, scars that received pressure garment therapy exhibited collagen organization more similar to that of uninjured skin, with smaller collagen fibers oriented parallel to the skin's surface compared with control scars, which exhibited thick, disorganized collagen fibers. Reductions in collagen deposition with pressure garment therapy are often attributed to fibroblast degeneration caused by restricted blood flow and a subsequent decrease in collagen deposition.<sup>3,6-8</sup>

Reduced collagen content in pressure garment therapy treated scars has also been linked to increased collagen lysis.<sup>3</sup> It has been previously shown that the type of injury (burn versus excision) and the treatment (thickness of autograft and expansion ratio) play a large role in extracellular matrix and inflammatory cytokine gene expression after injury.<sup>9,10</sup> Pressure application to human hypertrophic scar fibroblasts was also reported to reduce collagen type I expression and increase MMP9 and MMP12.<sup>11</sup> Expression of MMP2 and MMP9 was not altered here by pressure garment therapy, the increased duration of MMP1 elevation may facilitate extracellular matrix remodeling, suppressing excessive collagen deposition.

Burns are associated with an increased inflammatory response<sup>12</sup> and increased incidence of hypertrophic scars<sup>13</sup> compared with non burn injuries. Prolonged inflammation is thought to play a role in hypertrophic scar development. Multiple inflammatory cytokines have been implicated in hypertrophic scar formation, including TGF- $\beta$ 1, IL-6, and MCP-1,<sup>14-18</sup> supporting a role for these cytokines in hypertrophic scars. Furthermore, previous studies suggested roles for MCP-1 and TGF- $\beta$ 1 in cellular responses to mechanical force. Application of strain on human fibroblasts in vitro increased MCP-1 expression,<sup>19</sup> whereas offloading of incisional wounds in pigs decreased TGF- $\beta$ 1 expression and reduced scarring.<sup>20</sup> Based on the previous studies, it was predicted that expression of these cytokines would be correlated with the observed scar phenotypes in the four groups examined; however, gene expression differences between groups were relatively minor.

A recent study in human scars following cardiothoracic surgery found that hypertrophic scars were associated with a prolonged decrease in inflammatory gene expression compared with normal scars<sup>21</sup> which is somewhat contrary to the current dogma regarding inflammation and abnormal scar formation. However, those results may partially explain the failure of many anti-inflammatory therapies to significantly suppress

hypertrophic scarring.<sup>21</sup> Although mechanical force is believed to act, at least in part, by means of inflammatory signaling to regulate fibrosis<sup>19</sup> additional mechanisms are likely involved in the therapeutic response of burn scars to pressure garment therapy.

## Conclusion

Early pressure garment therapy initiation decreased scar contraction and thickness, resulting in improved biomechanics compared with delayed pressure garment therapy application and controls. Further study is needed to investigate the mechanisms controlling scar development during pressure garment therapy.

*Conflict of interest:* None

*Declarations:* None

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