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Plastic Surgery and Transplantation

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Volume 3 Number 1

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Original Article

Journal of Plastic Surgery and Transplantation
Volume 3 Number 1, January–June 2022

Role of Bone Marrow Aspiration Needle in Ear Piercing

[1]Barath Kumar Singh P, [2]Ravi Kumar Chittoria

How to cite this article:
Barath Kumar Singh P, Ravi Kumar Chittoria/Role of Bone Marrow Aspiration Needle in Ear Piercing/Journal of Plastic Surgery and Transplantation. 2022;3(1):9-11.

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Received on: 11-02-2022

Accepted on: 15-03-2022

Abstract

Earlobe piercing is a daily Out patient procedure done by a plastic surgeon. Various methods of ear piercing have been described. In this article, we describe a novel method of ear piercing using the Bone marrow aspiration needle which can be adapted and performed easily, cost effective, reusable by autoclaving. A 60 year old female patient underwent an ear piercing using a bone marrow aspiration needle. The ear piercing using this needle will help in reducing the cost to the patient in accessing the expert care at a lower cost. The advantages we noticed while using the bone marrow aspiration needle over conventional methods were more easily adapted and replicated. The disadvantage is the considerable trauma with chance of bleeding.

Keywords: Ear piercing, Bone marrow aspiration needle.

Introduction

The art of Ear piercing is a common process for the people all over the world. Now a days it has evolved as a part of their fashion process and the ear being the most common body part pierced. Although it is a routinely performed procedure, it is not without complications such as oedema, haematoma, infection and keloid formation. Various methods of Ear piercing technique have been described using intravenous needle, wire technique, lasers have been described (1) Ear piercing in the multiple sites of the ear rather than lobule has became a fashionable process nowadays (2) In this article we are going to discuss about the art of using the novel method of Bone-marrow Aspirationneedle (Fig. 1) in ear piercing.

Materials and Methods

An 60 year old female patient visited the plastic surgery outpatient department, with a desire to

Fig. 1: Bone marrow aspiration needle

get an ear piercing after the ear lobe repair, she bought her with a stud with large. After routine blood investigations had been done, the procedure was carried out in the department minor operation theatre. Adequate safety precautions were taken. The chosen site for piercing was marked. After ensuring adequate local anaesthesia, marked area was pierced with the bone marrow aspiration needle, Once the piercing done and Haemostasis attained, a gold stud was introduced through the tract with the help of the needle as a tract (Fig. 2). The same procedure was repeated on the opposite side.

Results

The ear lobe repair was done with assistance of bone marrow aspiration needle and was found to be useful as the procedure in a cost effective way and simple easily adaptable procedure, less painful

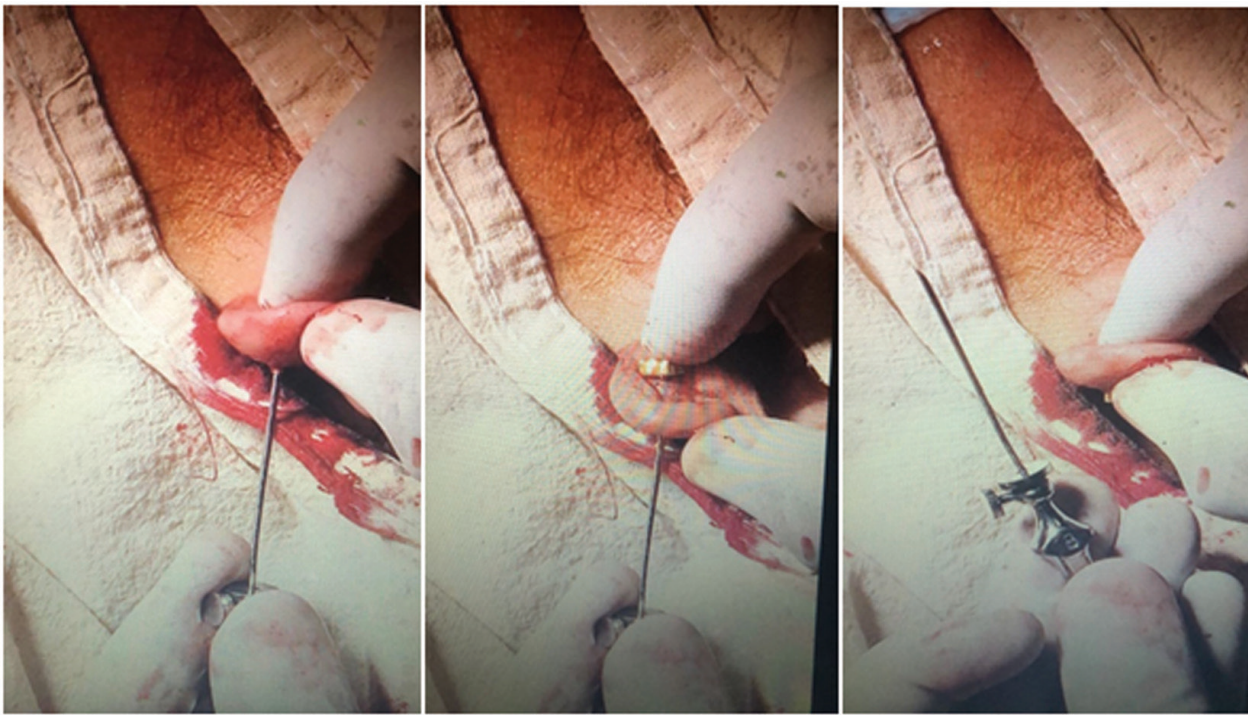

Fig. 2: Ear Piercing with the Bone marrow aspiration needle.

with minimal trauma. It works better with the ear piercing involving the lobule and women who uses large stud to wear.

Discussion

Various other methods of ear lobe piercing have been described as follows. Piercing guns used very commonly among jewellers did not gain much acceptance among doctors due to the higher incidence of infection (3). The wire technique which necessitates serial dilatation of the tract until the suitably sized ear stud can be placed is a painful process. The most common technique used is the railroading method, wherein an 18-gauge needle is railroaded over a 26-gauge needle over which the tip of the earring is guided through. A newer method of ear lobe piercing was described by Lamba

and Gupta, in which an 18-gauge BD Insyte-W intravenous catheter was used for piercing. The CO_2 laser has been used for ear piercing by Chang et al. in 2010.[3,4] The procedure can be carried out with topical local anaesthesia combined with various pre cooling methods used in conventional laser therapy such as cold gel application and Cryospray application. This avoids the need for an injection before the procedure and can be useful in children. Lasers used for Ear piercing are CO_2 Lasers and Er-YAG laser recently used. Bone marrow aspiration needle is a simpler instrument that can be carried easily, sterilised reused in a cost effective way, less painful, with minimal trauma and bleeding. It is helpful for the patients wearing large studs which is common in Indian women, who wears studs mainly in lobule part of the ear. It doesn't requires serial dilation to pass the large studs. The disadvantage is it associated with minimal trauma and bleeding . It cannot be used in ear piercing in younger female who chose to wear small studs. The high rate of ear piercing has led to an increased cases of perichondritis. Damage to the relatively avascular cartilage can cause ear prone to infection. The literature suggests that a piercing gun, mainly used by jewellers to pierce the lobule, may give more cartilaginous damage. The injury during ear piercing was in all techniques, causing perichondrium stripped from the cartilage around the needle tract, with maximum damage present on the exit wound. Cartilage fractures and loose fragments can happen after ear piercing.[5]

Conclusion

In this study, we found out it is useful in ear piercing with bone marrow aspiration needle as simple, easily replicable technique of Ear piercing mainly in the lobule part of the Ear. This method is useful for ear piercing mainly in the lobule who uses to large stud which is common in Indian subcontinent countries. Limitations of the study as this is the single case report, we need to use this procedure in the larger populations for further studies to assess the usefulness and complications of the procedure.

Conflicts of interest: None.

Declarations

Authors' contributions: All authors made contributions to the article

Availability of data and materials: Not applicable.

Financial support and sponsorship: None.

Consent for publication: Not applicable

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Original Article

Journal of Plastic Surgery and Transplantation
Volume 3 Number 1, January–June 2022

Role of Low Level Laser Therapy in Scar Management

Gopikrishna Mohanraj[1], Ravi Kumar Chittoria[2], Jacob Antony Chakiath[3]

How to cite this article:
Gopikrishna Mohanraj, Ravi Kumar Chittoria, Jacob Antony Chakiath / Role of Low Level Laser Therapy in Scar Management / Journal of Plastic Surgery and Transplantation. 2022;3(1):13-16.

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Received on : 27.04.2022

Accepted on : 31.05.2022

Abstract

It is well known that low level laser therapy (LLLT) has a role in the wound bed preparation of ulcers, wound healing process, joint stiffness and nerve regeneration, but the role of LLLT in the scar management is doubtful and has scanty data. In this case report we are sharing our experience in treating a scar with LLLT which showed enhanced response.

Keywords: Scar, Low level laser, Vancouver Scar Scale.

Introduction

Adult wound healing comprises following phases before forming a scar Inflammatory phase, proliferative phase and remodeling phase. Any factors that hinder the wound healing process will worsen the wound healing and will make a bad scar. Bad scar will make cosmetic problems and functional impairment of parts involved. The low-level laser therapy decreases fibrous tissue formation which makes up scar tissue. It softens the fibrotic nodules of the scar tissue and restores normal circulation, allowing nerves to regenerate. Its main aim is to restore the skins normal appearance following trauma, may it be via a burn, cut or surgery. Low level laser therapy (LLLT) is characterized by its ability to induce a non-thermic process (bio stimulation), and it is monochromatic, coherent, and polarized. This can be transmitted, reflected, refracted, and absorbed. The differences between the various types of laser beams produced are determined using wave lengths, power, irradiance, energy density, pulse duration, pulse repetition rate, area, and beam mode.[6] Considering

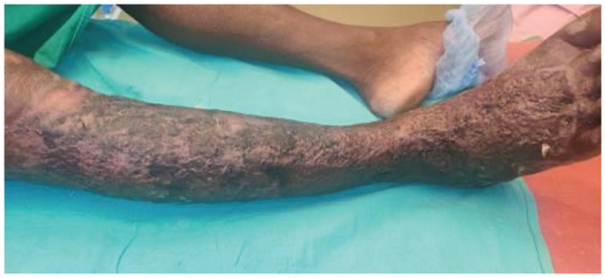
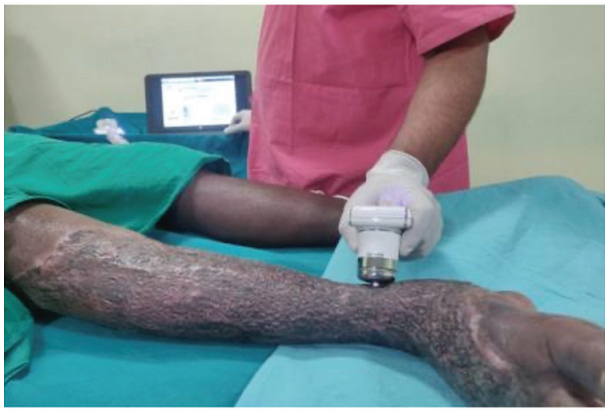


Fig. 1: Scar at the time of presentation



that the scars have a functional and emotional impact on people, they should not be considered as an afterthought, but as a change that must be addressed. ln this sense, LLLT therapy should be applied, since there were observed effects and results in wound healing.[1-4] The purpose of this case report was to analyze the effectiveness of LLLT on scar tissue, evaluating its effects in vascularity, pliability, pigmentation and height of the scar as per Vancouver Scar Scale (VSS).

Methods and Materials

The study was conducted in tertiary care level plastic surgery department after getting consent from the patient. The details of the patient as follows: 40 year old male with known diabetic for 10 years on treatment presented with post soft tissue infection raw area. Wound healed with bad scar (Fig. 1). Video dermatoscopy (Fig. 2) and Vancouver scar scale (VSS) used to asses the scar scale. Score was calculated to know extent of scar. LLLT was given to the scar in four sessions once a week for a total of four session. (Fig. 3) Wound inspection and dressing done after each session. Low level laser source we used was Gallium Arsenide (gas) diode red laser of wavelength 650 nm, frequency 10 KHZ and output power 100 mw, which was a continuous beam laser with an energy density of 4 J/cm2. Machine delivers laser in scanning mode (non-

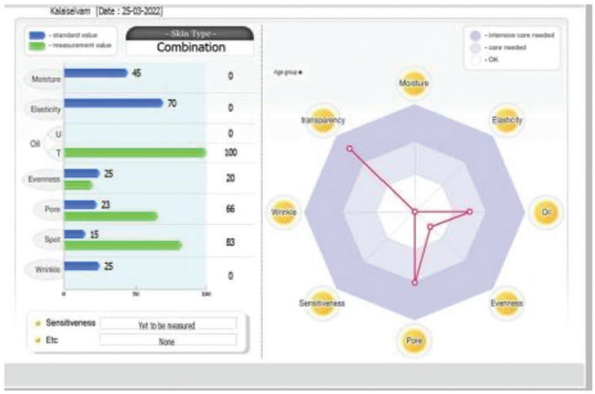


Fig. 2: Videodermatoscopy assessment of scar

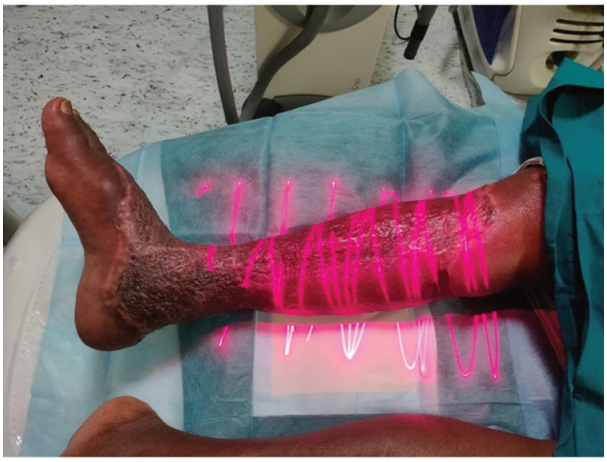


Fig. 3: Application of low level laser therapy on scar site

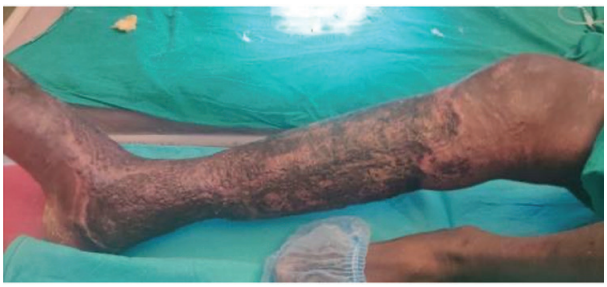


Fig. 4: Scar area at the time discharge. Scar improved well. VSS score at the time of discharge is 7/13 and video dermatoscopy shows improvement of scar.

contact delivery) with 60 cm distance between laser source and the scar. Scar received laser therapy for duration of 125 second every time for 15 minutes for 4 sessions, 1 week apart and Vancouver Scar Scale composed of vascularity, pliability, pigmentation and height of the scar was calculated. Total score of VSS 13 which was suggestive of bad scar. In our case, initial VSS score was 13/13.

Results

Low-level laser therapy has been found to be useful in improving scar vascularity, pliability, pigmentation and height. No side effects were observed during the study. The pre-procedural and post-procedural Vancouver scar scale (VSS) parameters are comparisons showed that there was a significant difference after laser application. The pre-procedural VSS score was 13/13. The post-procedural VSS score was 7/13. Post therapy clinical photograph also showed improvement. (Fig. 4)

Discussion

According to Huang colleagues (2009), an energy density between 3 and 5 J/cm2 has a best positive results in scar management in vivo[5], supporting the use of 4 J/cm 2 in the present investigation. Energy density appears to be the only treatment parameter with predictable dose dependent treatment effect according to Woodruff and colleagues (2004). These authors have no doubt that LLLT is an effective modality for treating scars. But they also found that the result may be dependent on wave length, pulse duration, irradiance, pulse repetition rate, treatment time, treatment repetition rate, or a combination of all these factors.[6-9]

Laser application did not change scars' length and width[10]. However, Hopkins and colleagues (2004) in a randomized controlled trial, in the first two phases of wound healing, found significant improvement in the scars when comparing the groups, but only in superficial scars (abrasions).[11]

Despite the lack of evidence on using VSS As standard one, the researcher chose to use them independently in order to observe differences in specific aspects[12] Scar's elasticity and color (as VSS items) improved significantly in echography with an improvement in pigmentation.[13] Height item VSS results suggested a ceiling effect. Brusselaers and colleagues (2010), in a systematic review of different scars' questioned scales as they are subjective to evaluate scars, depending on who applies them[14-16]. This aspect was partially controlled as evaluations were done by the same researcher.

Despite beneficial effects of LLLT, we cannot use LLLT in the pregnant female, irradiation of the neck region in hyperthyroidism; epilepsy; exposure of the retina. The contraindications that are doubtful under certain conditions are as follows: fever and infectious diseases; certain blood diseases; heavy blood losses; neuropathies; and irradiation in the region of gonads. The other contraindications reported in the literature are considered to be incorrect.[7]

Time of exposure and duration of treatment has to be standardized. We were given 4 session of LLLT each 1 week apart. In a case of Gaida K et al, he given twice week session for 8 weeks.[2]

The intervention with LLLT appears to have a positive effect on the macroscopic scars' appearance, and on old scars' thickness, in the studied sample. Their outcome didn't fulfill entire criteria of VSS[10] Based on above facts we managed our patient with low level lasertherapy as mentioned in the methodology part, we got a significant outcome as VSS score improved from 13 /13 to 7/13.

Conclusion

Based on the available facts we managed post infective wound scar with low level laser therapy and scar was improved from VSS score 13/13 to 7/13. Videodermatoscopy shows improvement of scar. The limitation of the study it was done on a single subject. Hence the authors suggest that a study including multiple subjects with a control group and multiple centre with randomization to validate the exact result.

Conflicts of interest: None.

Financial support and sponsorship: None.

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Original Article

Journal of Plastic Surgery and Transplantation
Volume 3 Number 1, January–June 2022

Effect of An Early Versus Late Ambulation Over Graft Take on the Lower Limb Autograft: A Comparative Study

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How to cite this article:
Naveen Kumar. Effect of An Early Versus Late Ambulation Over Graft Take on the Lower Limb Autograft: A Comparative Study. Journal of Plastic Surgery and Transplantation. 2022;3(1):19–26.

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Received on 22.10.2019; **Accepted on** 20.11.2019

Abstract

Background: Traditionally, patients who require lower extremity skin grafting remain on bed rest for several days. Despite the evidence advocating for early ambulation following split skin graft surgeries, studies reviewing plastic surgery departments nationwide have suggested that it has not been routinely practiced. The purpose of the study was to determine whether an early ambulation had any effect on a graft take as compared to the late ambulation in lower extremity autografts.

Methodology: A prospective comparative study was conducted involving 40 consenting patients in each group, treated between November 2015 to February 2017 in the Department of Burns and Plastic Surgery with a diagnosis of lower limb injury as per the inclusion and exclusion criteria was taken up for the study. One group was early ambulatory group (EAG) and another standard late ambulatory group (LAG). Size of the wound was measured using Graph sheet method. Various epidemiological and morbidity parameters were compared.

Statistical Analysis: was done using statistical software package SPSS v22.0.

Results: The mean duration of stay in hospital when compared was suggestive of significance of early ambulation. When graft take was compared between two groups, it was found that there is no significant difference in both groups. Pearson correlation coefficient analysis shows that subjects with greater wound size needed more number of days in resumption.

Conclusion: With this study one can conclude that immobilisation is not mandatory and mobilisation can be encouraged in lower limb autograft cases.

Keywords: Wound; Ambulatory; Immobilsation; Skin graft; Graft take.

Introduction

Traditionally, patients who require lower extremity skin grafting remain on bed rest for several days. It is a common practice to keep a patient immobile, who has undergone autografting in the lower extremity. Majority of the institutions keep their patients immobile for about 5 days whereas some other institutions immobilse the patient even longer.[1]

Determining when to ambulate the patient after a skin graft to a lower extrimity depends upon the establishment of circulation to the newly grafted area.[2] Typically majority of the revascularisation takes place between 4 to 6 days.[3] It has been presumed that before the revascularization, there is a risk of graft failure because of increase edema in the dependent limb, or as a result of shearing

forces to the graft itself.[4] For a minor injury it is a costly affair in terms of bed use. For elderly group of patients, prolonged immobilisation carries a significant risk of deep vein thrombosis and pulmonary embolism. In healthy subjects, short period of bed rest have been associated with loss of muscle strength, decrease in orthostatic tolerance, tachycardia, and decreased stroke volume and cardiac output.[5-7] Immobilization can lead to associated morbidity, such as decreased range of motion, reduced endurance, lack of independence in activities of daily living, prolonged hospital stay, increased costs associated with length of stay, and inhospital complications as well as inferior quality of life.

Patients who are ambulatory before autografting can safely ambulate on first postoperative day, without a fear of auto graft failure compared with those subjects who remain on bed for 5 days. These subjects have lesser pain, and are able to achieve independent ambulation faster.[4] Subjects who can remain ambulatory throughout their hospital stay, usually have less risk of acquiring the sequel which is associated with even short period of immobilisation.[4]

Some cases which are being done as a day care procedure, are advised for immobilisation. But residential condition of some of the patients, makes an ambulation unavoidable in them. Even then when patient comes for the dressing, surprisingly graft take is seen not hampered. This really seeds a doubt in the mind about the mandatory immobilisation for 5 days. Such doubt had encouraged us to start the study, where patient was made to ambulate within 24 hours of grafting.

There are number of studies that compare the graft take in early ambulatory and late ambulatory period and most of these studies have led to a conclusion that there is no difference in graft take between early and late ambulation group. But still, early ambulation has not been advised in most of the hospitals in India. The study had included previously ambulatory patients. Patients who were non ambulatory prior to the surgery such as patients with fractures and cellulities were ruled out. Patient with systemic co-morbidities had also been ruled out. Diabetes, malnutrition, cardiac pathology, steroid intake, all would intervene with the wound healing process and graft take.

Despite the evidence advocating for early ambulation following split skin graft surgeries, studies reviewing plastic surgery departments nationwide have suggested that it has not been routinely practiced.[8] The burn center follows a traditional ambulation protocol for the majority of its patients. Many of these patients are complex, with multiple comorbidities, systemic diseases, and are excluded from the studies on graftheal ing. Wallenberg had included the subjects with questionable peripheral arterial circulation as well as diabetics, and had concluded that the graft failure was related to systemic diseases rather than ambulation protocols. More research into such patient population is needed to determine whether they too may benefit from early ambulation after grafting.[9]

The purpose of the study was to determine whether an early ambulation had any effect on a graft take as compared to the late ambulation in lower extremity autografts.

Materials and Methods

A prospective comparative study was conducted involving 40 consenting patients in each group, treated between November 2015 to February 2017 in the Department of Burns and Plastic Surgery with a diagnosis of lower limb injury as per the inclusion and exclusion criteria was taken up for the study. One group was early ambulatory group (EAG) and another standard late ambulatory group (LAG). Ethical clearance was obtained from Institutional Ethics Committee with Ref. No. TP(DM/M.Ch) (5/2015)/IEC/PGIMER/RMLH-7843/15.

Inclusion criteria

1. Patient between 18 yrs to 60 yrs of age
2. Post-traumatic raw area, post-burns raw area, post-infective raw area suitable for grafting

Exclusion criteria

1. Patients with diabetes mellitus
2. Patients with peripheral vascular disease
3. Patient with lower extremity pitting edema
4. Patient who had developed cellulitis before surgery
5. Patient who were non ambulatory before surgery(fractures)

Flow of the study

- All patients who were referred to the Burns and Plastic Surgery Department with the complaint of lower leg injury were included in the study as per the inclusion and exclusion criteria after taking informed written consent.

- All the patients were given the standard primary care as per the hospital treatment protocol.
- Size of wound was measured in surface area using graph sheet (**Fig. 3**).
- Impression of wound was taken on graph paper and the number of boxes within the impression gave the surface area of the wound
- Once the wound became fit for grafting, grafting was done taking opposite thigh as a donor area.
- Compression bandaging was done using crepe bandage of 6 inch (**Fig. 1**).
- Ankle splint was also applied 5days postoperatively (**Fig. 2**).

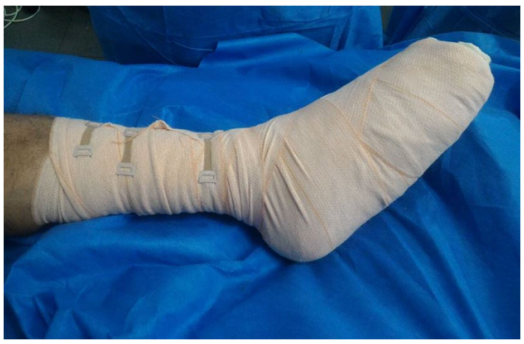

Fig. 1: Compression dressing given using crepe bandage.

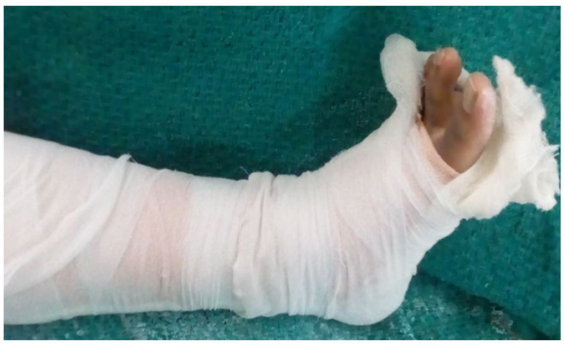

Fig. 2: Ankle splint given using Plaster of Paris.

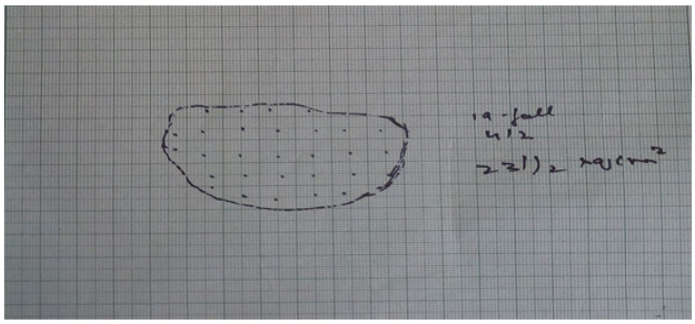

Fig. 3: Wound size measurement using graph sheet.

Study Treatment Protocol

A Standard treatment group

- Patients were seen on Postoperative days 1 to 4 for:

1. Positioning of the involved Lower leg.
2. Correct fit of ankle splint.
3. Patient was made ambulatory after 5 days.
4. Pictures of graft sites were taken for all subjects on Post-operative day 5, 10 and 15.

B Early ambulation group

1. Beginning on Postoperative day 1, they were seen for ambulation.
2. Before ambulating, the grafted limb was wrapped with compression bandages (crepe bandage).
3. Minimum ambulation of 50 meters 4 times a day was advised. Each subject was asked to ambulate until the subject was determined for not to ambulate any further.
4. Subjects were discharged when they were able to mobilize independentlyand required only dressing change at home.
5. Pictures of graft sites were taken for all subjects on POD 5, 10 and 15

Follow up

- All discharged cases were followed up at POD 5, 10 and 15.

Outcome parameters

a Epidemiological parameters:

1. Age
2. Sex
3. Type of injury
4. Areas grafted

b Early morbidity parameters

1. Duration of stay in the hospital
2. Distance of ambulation on each day
3. Graft was assessed on following criteria:

- Percentage of successful graft 'take', by measuring the size of wound preoperatively and on POD15.
- Photographs were taken intraoperatively and then on post-operative day 5,10 and 15

Statistical Analysis

Statistical analysis was done using statistical software package SPSS v22.0. Data is represented as mean ± SD. Continuous variables were compared using *t*-test. Chi-square test was done to compare the nominal data. Pearson's correlation coefficient was used to compare correlation between two continuous data. p value < 0.05 was taken as significant.

Results

The study was conducted for 20 months. 40 patients each were enrolled in each of two groups. Out of 40 patients in early ambulatory group, 2 of the patients were lost during the follow up.

Age

The mean age in EAG group is 41.21 and in late ambulatory group is 36.83

T-test analysis had shown that there was no significant difference in mean age between the two groups of subjects.

Table 1: Comparison of Age (in years) Between the Two Groups

Group	N	Mean	Std. Deviation	Std. Error Mean	*p* value
Ambulated	38	41.21	16.82	2.73	0.213
Non-ambulated	40	36.83	13.92	2.29	

Gender

In EAG group 31 patients were male, 7 were female. In LAG 31 were male and 9 were female. Chi-square analysis had shown that there was no significant difference in gender distribution of subjects. The chi-square value was 0.199 and the p value was 0.781.

Table 2: Gender Distribution of Subjects Between the Two Groups

Ambulated		Group		Total
		Ambulated	Non-ambulated	
Sex	Female	7	9	16
	Male	31	31	62
Total		**38**	**40**	**78**

Side of Limb

Chi-square analysis had suggested that there was no significant difference in side involved between the two groups. The chi-square value was 0.844 and the p value was 0.375.

Table 3: Comparison of Side Involved Between the Two Groups

Ambulated		Group		Total
		Non-ambulated	Non-ambulated	
Side	Left	22	19	41
	Right	16	21	37
Total		**38**	**40**	**78**

Duration of Stay in Hospital

The mean duration of stay in hospital was 3.34 in EAG were as it was 7.68 in LAG.

The duration of stay in early ambulatory group had significantly reduced compared to the late ambulatory group, which was proved statistically.

T-test analysis had shown that there was significantly greater hospital stay duration in non-ambulated group of subjects. The *p* value was <0.05.

Table 4: Comparison of Duration of Stay (in days) in the Hospital Between the Two Groups

	Group	*N*	Mean	Std. Deviation	Std. Error Mean	*p* value
Duration of stay in hospital	Ambulated	38	3.34	4.64	0.75	<0.001***
	Non-ambulated	40	7.68	5.05	0.79	

Wound Size

The mean size of wound in early ambulatory group is 95.68 and 103.38 in late ambulatory group. *T* tests analysis had shown that there was no significant difference in wound size between the two groups. The *p* value was > 0.05.

Table 5: Comparison of Wound Size Between the Two Groups

	Group	*N*	Mean	Std. Deviation	Std. Error Mean	*p* value
Wound size (sq cm)	0	38	95.68	79.90	12.96	0.653
	1	40	103.38	70.45	11.13	

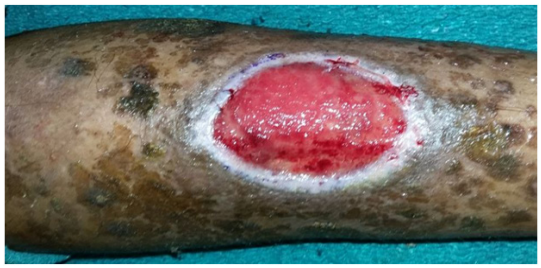

Fig.4: Pre-op: wound in middle 1/3rd of leg, which was grafted and made ambulatory.

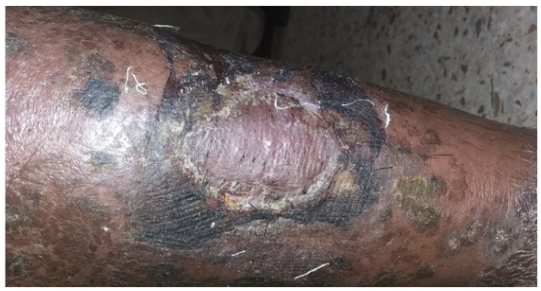

Fig. 5: Post-op day 15: showing almost 100% graft take.

Graft Take (Figs. 4,5)

The most important result was the graft take comparison between the two groups. The average graft take in EAG was 87.47 and 90.90 in LAG. There was no statistically significance difference in the graft take between the two groups. *T* test analysis had suggeseds that there was no significant difference in graft taken at 15 days between the two groups. The *p* value was > 0.05.

Table 6: Comparison of Total Graft Takes (in %) at 15 Days

	Group	*N*	Mean	Std. Deviation	Std. Error Mean	*p* value
Graft take (%)	Ambulated	38	87.47	15.07	2.44	0.262
	Non-ambulated	40	90.90	11.54	1.82	

Resumption of work

Even though statistically there was no significant difference between two groups, the early ambulatory group had resumed the work 2 days earlier than the late ambulatory group. EAG patients resumed work by 14.03 days in average and LAG patients resumed their work by 16.18 days.

T test analysis had suggested no significant difference in number of days required to resume normal activity. The *p* value was > 0.05.

Table 7: Comparison of Return to Normal Day-to-day Activity

	Group	*N*	Mean	Std. Deviation	Std. Error Mean	*p* value
Return to activity in days	Ambulated	38	14.03	4.54	0.738	0.279
	Non-ambulated	40	16.18	11.31	1.78	

Ambulatory Distance

As advised patients were made ambulatory for about 50 meters on day 1. And then the distance was increased day by day according to the patients compliance. The mean ambulatory distance on day 1 was 50, day 2 was 199.34, day 3 was 342.76, day 4 was 510.53 and on day 5 was 648.68 meters. Pearson's correlation coefficient analysis had shown that subjects with greater wound size needed more number of days in resumption of work in ambulatory group of subjects. Correlation coefficient (*r*) value was 0.477 and the *p* value was 0.002.

Table 8: Comparison of Ambulation Distance (in Meters) of Subjects in Ambulatory Group

distance of ambulation (meters)	Pod 1	Pod 2	Pod 3	Pod 4	Pod 5
Mean	50.00	199.34	342.76	510.53	648.68
Std. Error of Mean	0.000	21.75	31.427	42.719	54.083
Median	50.00	200.00	325.00	500.00	600.00
Std. Deviation	0.00	134.12	193.72	263.33	333.38
Minimum	50	50	50	100	50
Maximum	50	600	700	1000	1500

Discussion

A doubt always remains in surgeon's mind when it comes to early ambulation in lower limb autograft. As in traditional way of postoperative therapy in the lower limb autograft, immobilization has been advised for 5 or more days. A consensus has been revealed in the literature supporting immediate ambulation following lower extremity split-thickness skin grafting, noting that early ambulation neither improves or jeopardizes graft take if external compression is applied.[10–14]

Despite evidence advocating for early ambulation following split skin graft surgeries, plastic surgery departments nationwide is not practicing it routinely. The trend of early ambulation in lower leg auto graft will primarily prevent complications like deep vein thrombosis, pulmonary embolism, joint stiffness and prolonged hospital stays. Prolonged hospital stay will be an economic burden for patients. Need not to explain, if the patient is alone working member of the family then it affect the life of dependents significantly.

In our study patient with leg (below knee) wound was included and randomized into two group. One group is of traditional immobilization group and another is early ambulatory group who are made ambulatory on the same day of surgery. Inclusion and exclusion criterias were considered while selecting the cases. We had excluded patients with systemic illness. Wallenberg included subjects with questionable peripheral arterial circulation as well as diabetics, and concluded that graft failure was related to systemic diseases rather than ambulation protocols.[9] More research into these patient population is needed to determine if they too may benefit from an early ambulation after grafting. We have excluded patients with bony injuries in both groups, as one cannot follow the ambulatory protocol in these patients.

In the study, 40 consenting patients in each group were randomly selected. Group 1 was early ambulatory group and Group 2 being the late ambulatory group. Patients enrolled in both the groups were clinically examined to rule out any peripheral vascular disease and bone fractures. Any other systemic morbidities like diabetes mellitus, chronic anemia were ruled out. Required investigation were conducted. If required X-rays of pertaining part were also taken. Wound swab for culture sensitivity were also taken.

After strictly following the protocol as devised, the required paramaters were compared in both the groups. In early ambulatory group out of 40 patients, 2 patients were lost to follow up for unknown reason.

The result of graft take at postoperative day 15 were compared in both group. It was found that there was no significant difference in graft take in both groups. Mean graft take in percentage in early ambulatory group was 87.47 and 90.90 in late ambulatory group. *p* value being 0.262 (>0.05). Statistically also there was no difference in graft take. This study is comparable with other studies, which says there is no significant difference in graft take in both groups.

Wallenburg[9] had performed a RCT in which 50 participants were allotted in either ambulation a day after surgery with a graduated increase over 3 days and in time spent bed rest for 5 days. Wound healing were assessed in both groups. There was no significant difference in wound healing in both the groups. 80% in early ambulatory group and 88% in late ambulatory group had completed wound healing by 2 weeks.

Talon *et al*.,[15] after conducting a RCT concluded that there was no difference in outcomes between two groups and hence early ambulation did not impede graft take.

Grube *et al*.,[16] had studied a largest case series. It was retrospective study, which reviewed 100 patients treated with split thickness skin grafts to lower extremities who were encouraged to ambulate as early as 4 hours postoperatively. Graft take was described excellent (>95% graft take) in 86% of patients, satisfactory (85-94% graft take) in 10% and 4% required regrafting.

Duration of hospital stay in our study in the early ambulation group has significantly reducedas compared to the late ambulatory group. In early ambulatory group the mean hospital stay duration was 3.44 days when compared to 7.68 daysin late ambulatory group. It was proved significant statistically also as the *p* value was < 0.001 (<0.05). Hence an inference can be made. Economic burden that we see in the late ambulatory group can be significantly reduced if the patient has made ambulatory as in our study group. This result of ours is comparable with studies done by other authors.

Wells *et al*.,[17] in their study had concluded that there was no significant difference in graft take between two groups but there was a difference in length of hospital stay. Hospital stay significantly was reduced to 1.4 days when compared to 12.9 days of non ambulatory group. It was also estimated that early ambulation and discharge saved approximately $10350 (1995CDS)/per patient. Another study by Budny *et al*.,[18] which was RCT also concluded that the length of hospital stay in early ambulatory group was 2.3 days as compared to 12.1 days in late ambulatory group.

Dean and Press[19] in their retrospective case series study found to have reduced length of hospital stay in early ambulatory group. The average length of stay was 0.9 days.

Resumption of work: In our study, early ambulatory group had returned to the activity within an average of 14.03 days as compared to 16.18 days in late ambulatory group.

Most of our patients were daily wage workers like painters, masons, auto drivers etc. Some were office workers and some were businessmen. Whatsoever is the occupation, every patient wants to resume to their work as early as possible. Patients in early ambulatory group was shown to resume to their work 2 days earlier then late ambulatory group.

In a study done by Grube *et al*.,[20] was largest retrospective case series study. In 43 patients out of 100 cases work resumption could be determined. The average days for work resumption was 4.7± 3 weeks.

This study of ours also gives us the information that greater the wound size longer the time for resumption of work. Pearson's correlation coefficient analysis had also shown that subjects with greater wound size needed more number of days in resumption of work in ambulatory group of subjects. Correlation coefficient (*r*) value was 0.477 and the *p* value was 0.002.

Conclusion

The purpose of this study is to know whether early ambulatory group jeopardise graft take as compared to conventional group of late ambulatory. The question which arises thereafter is, Is Immobilisation mandatory in lower limb autograft?

The results of this study suggests that immobilisation is not mandatory in previously ambulatory patients who are medically and psychologically stable. Early mobilization does not jeopardise or fasten graft take. Graft take in both the groups is comparable. In fact we can avoid secondary complications like deep vein thrombosis, pulmonary embolism due to immobilisation.

The economic burden over both patients and hospital can be reduced. This is proved with significantly decreased hospital stay in early ambulatory group when compared to conventional

late ambulatory group. This is of utmost significance in developing countries like us where health care insurance is yet to cover majority of population.

Patient in early ambulatory can also resume their work early when compared to conventional late ambulatory group. Hence early mobilisation in lower limb autograft can be advised, provided a good compression dressing is given in every case during ambulation.

With this study one can conclude that immobilisation is not mandatory and mobilisation can be encouraged in lower limb autograft cases.

Conflict of Interests: None

Funding Source: None

Ethical Approval: All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards

Abbrevations:

EAG–Early ambulatory group.

LAG –Late ambulatory group.

POD–Postoperative day.

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Original Article

Journal of Plastic Surgery and Transplantation
Volume 3 Number 1, January–June 2022

Innovative Application of Selfie Stick with a Tripod for Smart Phone Based Video Conferencing in Telemedicine

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How to cite this article:

Ravi Kumar Chittoria, Chirra Likhitha Reddy, Abhinav Aggarwal, *et al*. Innovative Application of Selfie Stick with a Tripod for Smart Phone Based Video Conferencing in Telemedicine. Journal of Plastic Surgery and Transplantation. 2022;3(1):27–29.

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Received on 12.10.2019; **Accepted on** 20.11.2019

Abstract

Videoconferencing and live surgical workshops are an integral part of plastic surgical training and practice. It may be difficult to follow through the whole procedure staying at one place as they may last for a long duration. We would like to present an innovative application of selfie stick with a tripod for video conferencing in telemedicine.

Keywords: Selfie stick; Video conferencing; Telemedicine..

Introduction

Smart phones are a part of our day to day activities. Smart phones have replaced the conventional camera for digital imaging and record keeping.

They are also used for video conferencing, for live workshops. Operative videos are a part of record-keeping, teaching, and knowledge sharing instruments among plastic surgery fraternity.[1]

But it becomes cumbersome to use the phone or video recording equipment for a prolonged period of time as we have to hold them in our hand and also we have to be stagnant at one place. Selfie sticks with Bluetooth control are being used for these purposes in various places.[2]

Tripods have been used for video recording using smart phones. This reduces the need for an assistant.

We would like to present one such innovative application of selfie stick with a tripod for video conferencing.

Materials and methods

- A selfie stick with a detachable tripod stand with a slot for the smart phone [Android/iOS] (**Fig. 1**)
- The tripod was made of plastic and the selfie stick which was of adjustable length was made of aluminum.
- Bluetooth remote (**Fig. 2**)
- Android or iOS-based smart phone with Bluetooth connectivity and atleast 3G internet connectivity
- A commercially available selfie stick with a tripod and Bluetooth remote was obtained. We connected this with an android based smart phone [version 9]

This was used for video conferencing and telemedicine using Wi-fi with skype calling facility (**Fig. 3–5**). Calls may be made through any of the

video calling applications available online.

Feedback was obtained from users based on a questionnaire (**Fig. 6**).

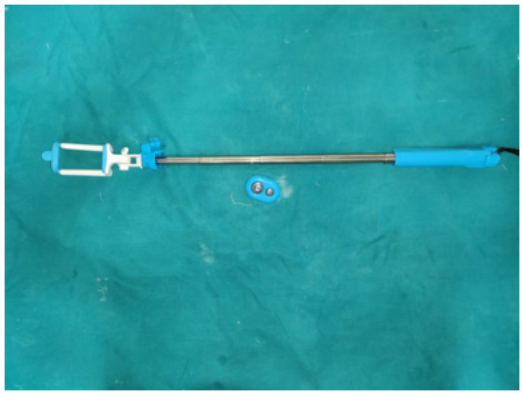

Fig. 1: Selfie stick with detachable tripod stand and Bluetooth.

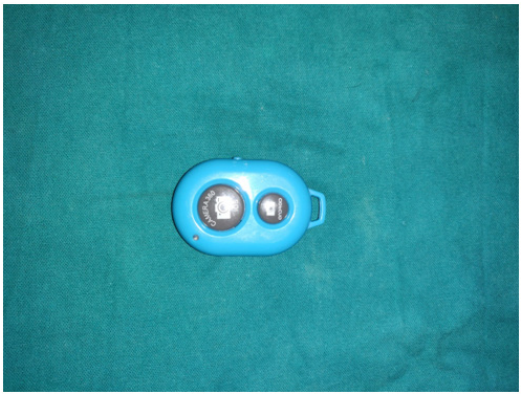

Fig. 2: Bluetooth remote for operating the mobile device.

Fig. 3: Selfie stick with tripod.

Fig. 4: On going video-conferencing.

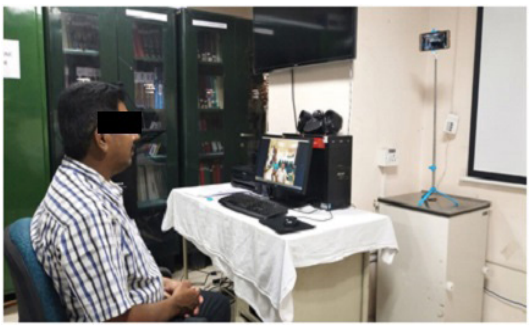

Fig. 5: Screen mirroring for larger audience.

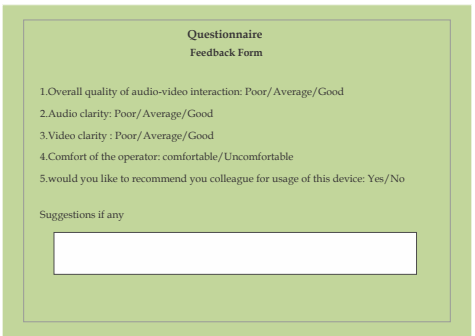

Fig. 6: Feedback forms.

Results

The device was used by 5 different users for telemedicine and video conferencing. The users found it a helpful tool and would recommend it to their peers. All of them found the audiovisual quality satisfactory. All the users found it easy to use.

Discussion

Video conferencing in telemedicine is a process that can be used to attend meetings, do live workshops of surgeries, etc. While video conferencing or watching live surgeries we have to sit in front of a desktop or laptop at one place as most of these procedures take a lot of time.

It may be difficult for busy surgeons to dedicate such a large amount of time in one place. In such times, while on the go, we can hold the phone in our hand or use a selfie stick to hold the smart phone and continue with the video conferencing. However, arm fatigue is a common problem after a few minutes. In such situations, a selfie stick with tripod may be used to hold the smart phone and the conference may be continued. It may also be connected to a projector for a larger audience. In rural settings where setting up of a projector may be difficult, selfie stick with tripod may be of immense help especially when a large audience is involved.

Most of the videoconferencing equipment are expensive, need a formal setup and large space. This innovative cost-effective use of selfie stick with tripod may help, not only to individual surgeons but also to a large audience, especially in small, rural areas where formal setup may not be possible.

The drawback of this is that only a small mobile screen is available of teleconferencing. Another disadvantage is the need for good Wi-fi or mobile network connectivity with 3G or 4G is required for better audiovisual quality.

Conclusion

This innovative cost-effective selfie stick with tripod may be useful in telemedicine.

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Review Article

Journal of Plastic Surgery and Transplantation
Volume 3 Number 1, January–June 2022

Versatility of Negative Pressure Wound Dressings in Plastic Surgery

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How to cite this article:
Leon V Alexander / Versatility of Negative Pressure Wound Dressings in Plastic Surgery / Journal of Plastic Surgery and Transplantation. 2022;3(1):31-37.

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Received on: 22-04-2022

Accepted on: 26-05-2022

Abstract

Negative wound dressing, also known as Vacuum-assisted closure (VAC) dressings, have become a staple for most plastic surgeons when managing difficult wounds. But nowadays, the scope of VAC dressings has broadened and includes burn wounds, open fracture wounds, radiation wounds, post-surgical wounds, abdominal wounds and post-traumatic complex wounds. This review discusses the mechanism of action of VAC, applications, pros and cons of this technique and finally, the future directions and research that must be done to refine this technique.

Keywords: Vacuum-assisted closure, Wound healing, Wound shrinkage, Negative pressure wound therapy, complex wounds, Microdeformational wound therapy.

Introduction

The technique of negative pressure wound therapy was first introduced by Argenta et al. (1997) for the healing of chronic wounds[1] and, since then, its scope has broadened considerably to include the healing of open fracture wounds[2], burn wounds[3], pressure ulcers[4], post-surgical wound complications[5], post-traumatic complex wounds[6], abdominal wounds[7] and radiation ulcers[8].

NPWT affects wound healing by four basic mechanisms - macro deformation, micro deformation, fluid removal, and alteration of the wound environment. Various secondary mechanisms are described in the literature (including neurogenesis, angiogenesis, modulation of inflammation, and alterations in bioburden).[2] This review article aims to provide a comprehensive review of the literature on NPWT, its applications in plastic surgery, and the future of this emerging technology in healing difficult wounds.

Discussion

The use of VAC dressings in the healing of chronic and difficult to heal wounds is well established and has provided a viable alternative option to the reconstructive surgeon. The basic mechanisms through which this modality works have been described in the literature and are worth recapitulating; it includes four primary mechanisms: macro deformation, micro deformation, fluid removal, and alteration of the wound environment. Macrodeformation is a phenomenon that causes the foam to collapse due to the negative pressure effect of suction, resulting in wound shrinkage. The resultant deformational forces draw the wound edges closer, expediting wound healing.[9] Negative pressure of 125 mm of Hg can reduce the volume of the VAC sponge by almost 80% resulting in significant wound contraction. However, the extent of contractability is largely dependent on wound deformability.[10-12] Microdeformation involves mechanical forces such as compression and tension from the foam, shear and hydrostatic forces from the extracellular fluid, and the effect of gravity that are transmitted all over the wound via the extracellular matrix. Microdeformation occurs at the microscopic level due to the interplay between these forces that affect the cytoskeleton. These forces activate a signaling cascade that upregulates granulation tissue healing and promotes accelerated wound healing. Microdeformation causes localized tissue hypoxia that causes increased vascularity and ingrowth of new vessels (neovascularization) toward the wound.[13] NPWT is believed to remove fluid from the wound via two mechanisms. First, VAC reduces the burden on the lymphatic system by directly removing fluid from the wound. Second, it gradually induces an increase in the density of lymphatics at the wound edges.[14] Finally, VAC alters the wound environment by removing electrolytes and proteins along with the fluid. This, in turn, stabilizes osmotic and oncotic gradients at the wound surface (Fig. 1).

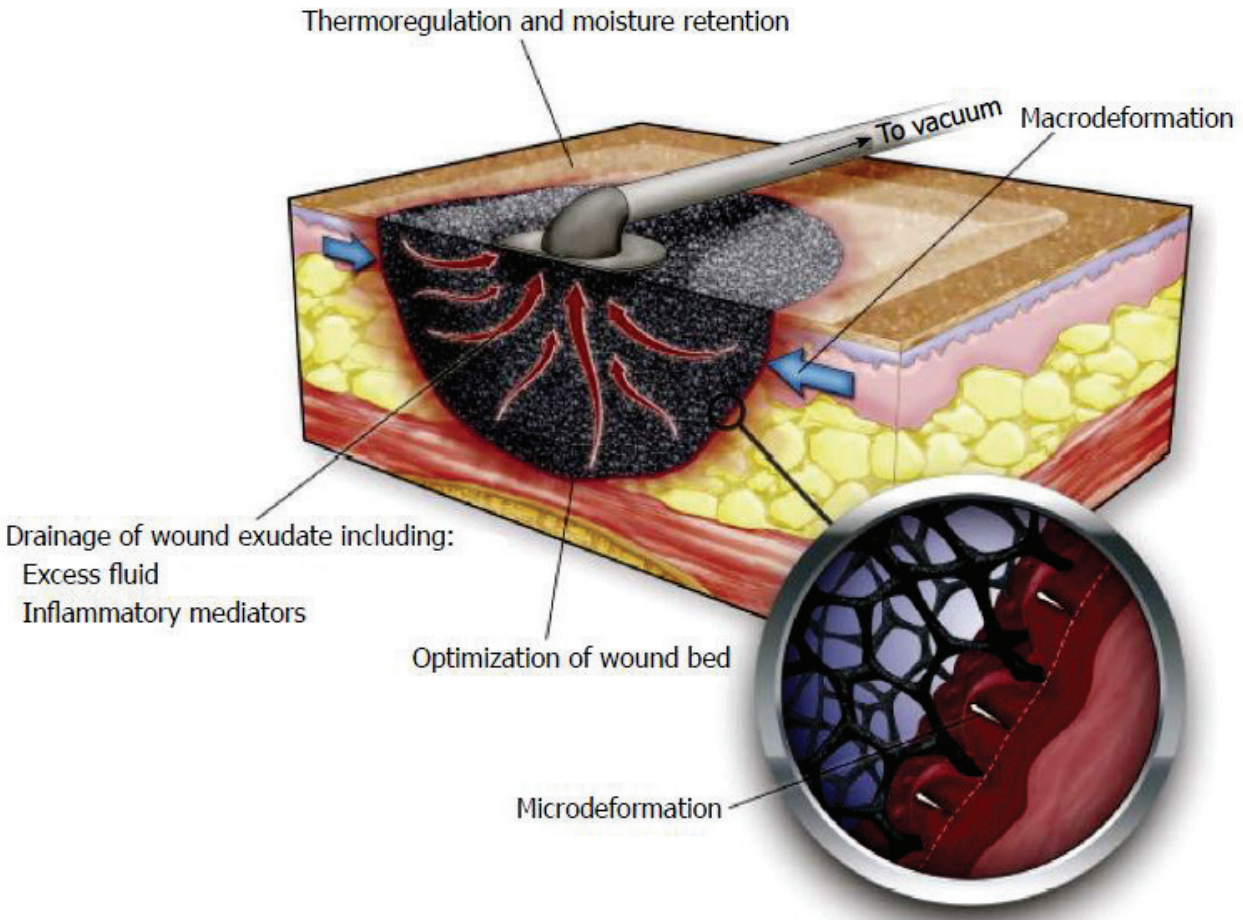

Fig. 1: The primary mechanisms of microdeformational wound therapy: (1) Macrodeformation; (2) Microdeformation (3) Fluid removal; and (4) Alteration of the wound environment.[2] Reproduced from, Huang C, Leavitt T, Bayer LR, Orgill DP. Effect of negative pressure wound therapy on wound healing. CurrProbl Surg 2014; 51: 301-331. Copyright 2016 by Elsevier.

The secondary effects of VAC therapy include: Neurogenesis due to upregulation of neurotrophin nerve growth factor, substance P, and calcitonin gene-related peptide leading to enhanced neural growth and neuropeptide expression[15]. VAC therapy can promote haemostasis as the negative suction pressure can occlude blood vessels mechanically, reducing bleeding from the wound surface. Second, the negative pressure induced by VAC strongly apposes the dressing to the wound surface, favouring clot formation[16]. NPWT maximizes angiogenesis and tissue perfusion with increased microvessel density[17]. NPWT activates the wound healing process by inducing inflammation with increased cellularity of wound exudate with elevated erythrocytes and leukocytes, increased gene expression of leukocyte chemoattractants, such as CXCL5 and IL-8, while removing harmful products of inflammation such as infiltrating leukocytes, cytokines, and matrix metalloproteinases[18]. VAC therapy promotes granulation tissue formation, cell proliferation, and blood vessel sprouting[19]. It has been postulated that VAC therapy leads to a decreased bacterial colonization in the wound due to the mechanical effect of suction, and the enhanced neovascularization; increased blood flow builds up tissue resistance by increasing oxygen tissue levels in the wound.[20]

Clinical uses of NPWT

1. Management of open wounds: NPWT has been used to expedite the healing process of chronic non-healing ulcers (e.g., chronic diabetic wounds, vascular ulcers, neuropathic ulcers, pressure sores)[21].
2. Complex surgical wounds: VAC therapy has been used to fortify the closure of complex surgical wounds and skin graft immobilization as a tie-over bolster dressing. The advantage of the incisional VAC (iVAC) therapy is to enhance wound healing due to strict immobilization, enhanced vascularity and healing with the prevention of surgical site infections[22].
3. NPWT in burns: VAC therapy has been shown to improve the vascularity of burn wounds[23]. It has also been used to bolster the adherence of dermal substitutes in the healing of burn wounds and in the long term improves the elasticity of such healed burn scars[24]. It acts mainly to decrease wound exudate, and bacterial load and expedites wound healing. VAC therapy is also indicated in full-thickness burns (third and fourth-degree burns) to favour the formation of granulation thereby ensuring a good take of skin graft resurfacing[25].
4. Open fractures: NPWT has been used in difficult wounds with exposed bone and open joints, where it keeps the wound moist, and prevents desiccation and bacterial contamination. The wound healing process in such wounds is also accelerated with VAC therapy.
5. Deep infected wounds (body cavities: abdominal, thorax/sternotomy wounds): NPWT, when used in deep wounds, was found to decrease bacterial load, inhibit infection induced tissue necrosis, and induce early initiation of granulation tissue formation.[21,26,27]
6. Skin graft immobilization: NPWT is used in STSGs in the place of a tie-over bolster, which is traditionally used to immobilize the graft. NPWT stabilizes the graft, drains excess fluids, and promotes better contact for graft incorporation enhancing vascularization.[28,29] NPWT has successfully been used in degloving injuries to immobilize skin grafts, or as an adjuvant treatment with a dermal matrix (Fig. 2).[30]
7. Postoperative salvage of flaps: NPWT has been shown to decrease the risk of reoperation in cases of congested lower extremity pedicle and free flaps by decreasing venous insufficiency and tissue oedema, promoting granulation and, hence, preventing further flap necrosis.[31]

Newer Modalities/Variations of VAC

1. Silver incorporated VAC dressing: Various bioactive factors have been incorporated in NPWT to enhance efficacy. Silver was added to the coating of the PU foam to decrease the bacterial load in the wound. In complex infected wounds, silver dressings placed beneath the negative pressure dressings resulted in a decrease in the bacterial load[32].
2. Instillation therapy is the injection of fluid, such as normal saline, into the wound through a port on the NPWT connecting tube to enhance wound healing. This technique has been successfully applied in chronic wounds to reduce bacterial concentrations in the wound before split skin grafting (SSG). In continuous-instillation NPWT, a second port is connected to the continuous drip system,

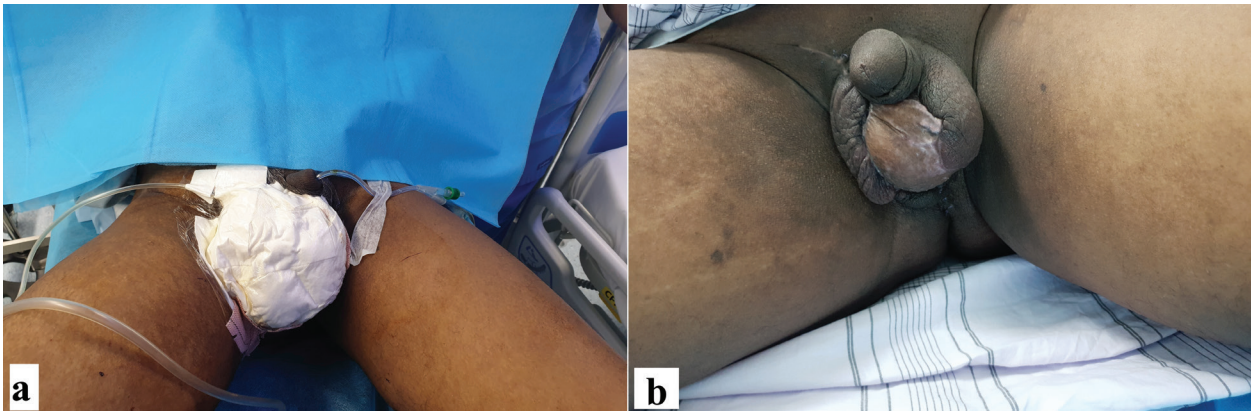

Fig. 2a: VAC dressing used for skin graft immobilization over a difficult site of the body (scrotum). 2b: The final result after 3 months showed a full take of the skin graft.

which can allow continuous irrigation of a fluid, for example, antibiotic solution, to decrease the time required for wound healing[33,34].

A new form of NPWT with instillation and dwell time (NPWTi-d) has been developed and promoted to heal complex, infected wounds associated with decreased vascularity. This system NPWTi-d (V.A.C. VeraFlo™ Therapy; 3M + KCI, San Antonio, TX) involves using a reticulated open-cell foam dressing with the transparent airtight film dressing connected to the VAC suction machine. Then, normal saline is instilled until the foam is saturated for a one-second dwell time, followed by six hours of continuous negative pressure (−125 mm Hg). The one-second dwell time simulates frequent wound irrigation, which avoids the need to soak the foam for longer periods (Fig. 3).[35]

3. Incisional VAC therapy (iVAC)/ closed incision negative pressure therapy (ciNPT): The literature supporting the use of NPWT over clean incisions has mixed results.

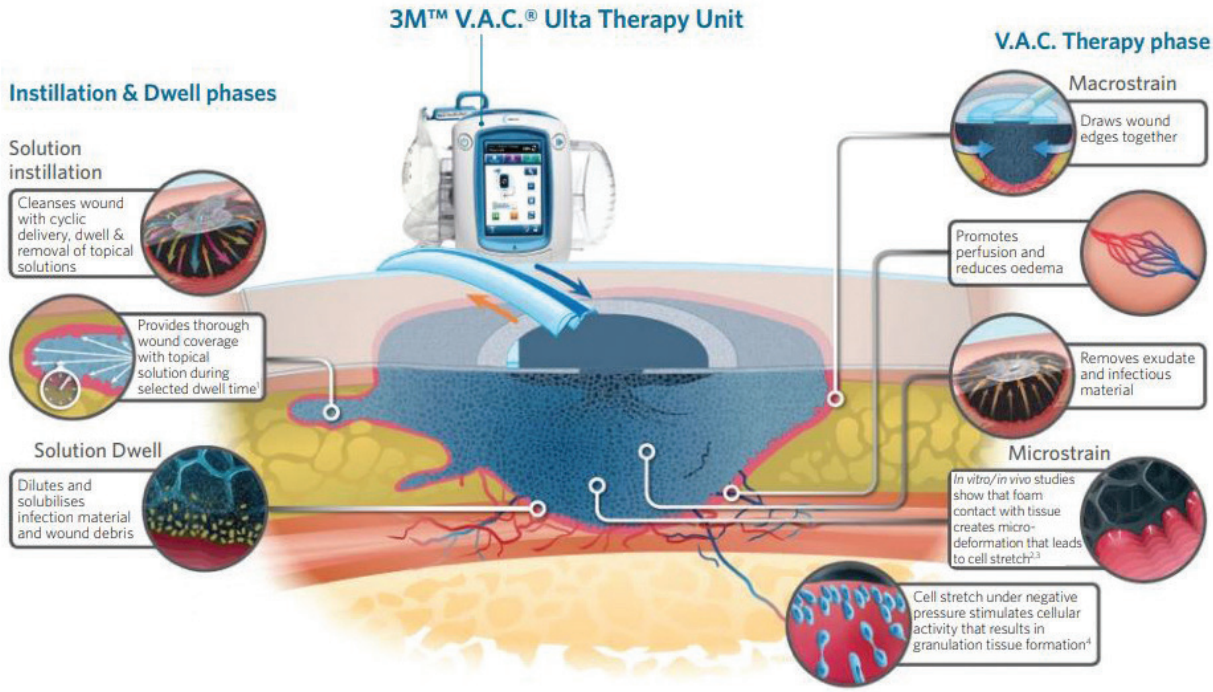

Fig. 3: Instillation and dwell time (NPWTi-d) VAC therapy with the Veraflo system. NPWTi-d combines NPWT with the addition of wound cleansing with topical wound solutions. Reproduced from, Rycerz AM, Slack P, McNulty AK. Distribution assessment comparing continuous and periodic wound instillation in conjunction with negative pressure wound therapy using an agar-based model. Int Wound J. 2013 Apr;10(2):214-20.

Decreased rates of seroma, as well as haematoma formation, have also been reported in post-bariatric patients receiving incisional NPWT. VAC applied to closed incisions also decreases the risk of infection[36,37].

Periincisional lateral stress is reduced by approximately 50% following NPWT application and the directions of these stress vectors mimicked the distribution found in intact tissue. Evidence from this research has supported the development of systems such as Prevena™ Incision Management System (KCI, San Antonio, TX) which is specifically designed to be used in incisional wounds[38].

Future Directions & Research

The optimum pressure for VAC therapy is still yet to be comprehensively studied, and in the literature, the accepted suction pressure ranges from 50-150 mm Hg. Lower pressure (50-75 mm Hg) are best used in circumferential wounds, painful chronic wounds and in those cases where NPWT is used as a dressing for free flap immobilization. Higher pressures (150 mmHg and greater) are used for large compartmental and exudative, infective wounds[3,39].

The optimal cycling regime for VAC is yet to be comprehensively studied. Another area that can be studied is the development of an ultraportable, mini-VAC machine that allows the patient unlimited degrees of freedom to carry on with his/her daily activities without disruption. Future multicenter randomized controlled studies comparing the different materials, suction pressure, types of VAC therapy and instillation of fluids, will help us evaluate this technique better and optimize its usage in the management of difficult wounds and perhaps expand its horizons further.

Conclusions

VAC therapy/NPWT has revolutionized the management of difficult surgical wounds and is now an established alternative when other options have been exhausted. Its use has expanded to include the management of almost every type of surgical and non-surgical wounds. However, the overall evidence regarding this emerging technology is still lacking despite its popularity. Future High-level research trials must be carried out to establish the ideal and optimal parameters of its use so that its effectiveness and efficiency can be further enhanced.

Acknowledgement: None

Conflict of Interest: None

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