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Comparison of the Effectiveness of Dermapen Using Trambosit Plasma and Scar Serum Dermapen Actions on Scar Acne Areas on the Skin Surface of Wistar Female Rats (Rattus Norvegicus)

Mohamad Riza Al Djoefri[1], Wienaldi Wienaldi[2], Muhammad Chailur[3], Boyke Marthin Simbolon[4]
[1,2,3,4]Biomedical Science Masters Study Program, Faculty of Medicine, Dentistry and Health Sciences, Universitas Prima Indonesia, Indonesia

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ABSTRACT

This study aimed to analyze and compare the effectiveness of the action of dermapen using plasma from platelets with the movement of dermapen using scar serum on pockmarked areas on the skin surface of female Wistar rats (Rattus norvegicus). The results of wound observations based on the period (days) with an average healing time of 10.4 days and 12 days needed by each mouse to close the wound in the PRP dermapen group were faster than the serum scar group. This can be explained by the PRP content containing growth factors important for wound healing and tissue regeneration, thus accelerating healing. Meanwhile, scar serum contains concentrates that are useful for nourishing and moisturizing the skin, which can easily penetrate the deepest layers of the skin, thereby accelerating skin regeneration. Further microscopic studies, such as histopathological studies, are needed to examine the number of fibroblasts.

Email :
dr.wienaldi@gmail.com

1. INTRODUCTION

The human body is made up of many tissues and organs, one of which is the skin. The skin is the largest organ in the body. It covers the entire external surface of the body consisting of three layers, the epidermis, dermis, and hypodermis, all of which vary greatly in anatomy and function [1]. The skin, as the outer part of the human organ, can be directly exposed to interference from the outside. Disturbance or injury to the skin can disrupt the integrity of the skin [2].

One of the skin disorders or problems that often get attention is pockmarks. Every year, more than 100 million patients experience scar formation caused by various factors, such as post-inflammatory acne and trauma. Scar tissue is naturally a protective mechanism against tissue damage. Skin tissue repair results in a spectrum of scar tissue types, such as atrophic, hypertrophic, and keloid scars. These pockmarks are caused by the destruction of collagen following acne inflammation and are usually correlated with acne duration, lesion severity, and delay in therapy [3]. These pockmarks can continue to widen if the skin has new wounds or inflammation around them.

Acne scars are the result of inflammatory acne blemishes. Acne pores swell, and there is damage to the pore walls. The skin's response is to repair scars by forming new collagen fibers [4]. Scars occur because the body is trying to improve acne. How the body responds to injury determines whether and how much scar tissue it will have. The repair process includes the creation of collagen. If there is too much collagen, then a raised scar will appear. Another scarring is caused by tissue loss, which creates a hole or indentation in the skin [5].

During the wound healing period, pimples or scars appear due to a lack of collagen, causing spots to form in the holes that make the skin uneven. When the accumulated fat (acne content) is squeezed out, a wound cavity forms in the skin, or even some dermis tissue rises [6]. The body responds by producing collagen to repair the damage. However, because the wound is too large or deep, the amount of collagen produced is insufficient, so the repair is unsuccessful. As a result, the skin still looks uneven, hollow, or even like a hole from the outside.

Spots or acne scars can affect those involved' s psychological and social aspects, especially when they appear in young adulthood. Acne scars can confuse, cause a lack of confidence, and even severe depression, which can affect the quality of life of sufferers and can even be life-threatening [7]. In a study of 2155 volunteers aged between 18 and 70, 0.8% of men and 0.5% of women showed atrophic facial scars. Severe scarring associated with acne can have substantial psychosocial effects and should be treated promptly to minimize resistance to treatment [8]. Treatment for acne scars varies by type. The most common acne scars are atrophic scars which are squiggly pockmarks. Its features include the appearance of pools of different sizes. Depending on the depth, there are three types of acne spots: ice pick, rolling, and boxcar. In some people, acne scars can also occur due to the development of scar tissue [9].

The high prevalence, significant impact on quality of life, and therapeutic challenges posed by acne scars have led to the development of various treatment options, such as chemical peels, dermabrasion, laser treatment, fat transplantation, microneedling, subcision, and combination therapy [8]. One of the methods or actions that can be taken for pockmarked therapy is skin needling, which is an action aimed at repairing pockmarks using a fine, sterile needle. Skin needling, also known as Collagen-Induction Therapy (CIT) or microneedling therapy, aims to induce the formation of new collagen/elastin fibers by releasing several growth factors and increasing drug absorption and penetration into the skin [7].

One of the tools used in skin needling procedures is known as a dermapen. The Dermapen is an automated microneedling device that resembles a ballpoint pen [10]. This ergonomic device uses disposable needles and guides to adjust needle length for fractional mechanical resurfacing. The tip has 9-36 hands arranged in rows. It uses a rechargeable battery to operate in five-speed modes, the highest speed mode (700 cycles/min) and the lowest speed mode (412 cycles/min), in a navigation stamp-like manner.

The Dermapen has the advantage of being reusable on different patients because the needles are interchangeable. This tool is also safe because the needle tip is hidden in the guide, and it is more comfortable to reach narrow areas such as the nose, around the eyes, and lips. These advantages make the procedure less painful and more economical. This technology has been designed to overcome the problem of varying pressure applications and the subsequent attainable penetration depth—needle depth range from (0.25mm to 2.5mm) [11].

Dermapen induces collagen and elastic tissue synthesis with minimum epidermal injury, enhancing acne scar remodeling. Many studies have been conducted to evaluate the effectiveness of dermapen microneedling treatments. Still, few of these researchers have highlighted the significance of dermapen in severe forms of atrophic acne scarring and dark-skin individuals [12]. Chalabi's study concluded that dermapen microneedling therapy has a moderate to good response in the form of severe acne scars but does not provide excellent results, so further research is needed. The principle of action of this dermapen is to make a skin wound so that anesthesia is necessary and done in a sterile manner. After the procedure, it can also be combined with other stem cells or active ingredients. One of the dermapen action combinations is plasma from platelets or platelet-rich plasma (PRP).

Platelet-rich plasma (PRP) is a high concentration of platelets in a large amount of plasma. Platelet-rich plasma (PRP) is the plasma fraction with a higher concentration of platelets relative to whole blood, typically 3 to 7 times the average concentration of platelets in whole blood. Platelets contain a-granules, and after activation, they secrete several growth factors, such as transforming growth factor-b, platelet-derived growth factor, vascular endothelial growth factor, etc. These growth factors and other proteins, such as adhesion molecules and chemokines, interact with the local environment to drive cell differentiation, proliferation, and regeneration [13].

PRP is used in several fields of medicine, such as aesthetics, plastic surgery, orthopedics, dentistry, trauma and wound care, ophthalmology, and gastroenterology as part of regenerative medicine. In recent years, PRP has been used for various dermatological indications, including wound healing, scar management, skin renewal and rejuvenation, hair loss (alopecia), fat transfer, and soft tissue volume augmentation [14]. PRP has shown promise in dermatology as an adjunct to ablative fractional CO2 lasers and non-energy non-invasive techniques for treating atrophic acne scars [8]. PRP also treats various conditions such as boils, facial rejuvenation, acne scars, periorbital

hyperpigmentation, alopecia areata, and androgenetic alopecia [15]. Platelet-rich plasma (PRP) is autologous blood plasma with platelet concentrations well above baseline. The normal concentration of platelets in the blood is about 150,000 to 400,000 platelets per cubic microliter. PRP contains 4 to 7 times the physiological concentration of platelets. PRP is prepared by centrifuging blood collected from the patient before any procedure or surgery [16].

Based on the descriptions above, it shows that plasma from platelets or known as platelet-rich plasma (PRP), is widely used for several dermatological indications, including the management of acne scars, and can increase the rate of proliferation because it has bioactive molecules that are known to have efficacy as growth factors in tissues. The benefits of plasma from platelets or PRP, as well as the huge dermapen action in acne scar therapy, are important reasons for researchers to examine the effectiveness of dermapen action using plasma from platelets (PRP) and compare it with the dermapen step using scar serum which is widely sold commercially. This is what motivated the researchers to conduct an experimental study to compare the effectiveness of the action of dermapen using plasma from platelets with the movement of dermapen serum scar on pockmarked areas on the surface of the skin of female Wistar rats (*Rattus norvegicus*).

2. METHOD

This research is a pure laboratory experimental study with a research design using a post-test with a control group design [17]. The focus of this study was to determine the difference or comparison of the effectiveness of the action of dermapen using plasma from platelets with the movement of dermapen using scar serum on pockmarked areas on the skin surface of female Wistar rats (Rattus norvegicus). The samples in this study were adult female white rats (Rattus norvegicus) weighing 160-200 grams and 2-3 months old. The Wistar rat is one of the most widely used experimental animals as a model in biomedical research because it has almost the same characteristics and physiology as humans [18].

Research variables are everything that will become the object of research observation [19]. The variables in this study consist of independent variables and dependent variables. The independent variables in this study were dermapen using plasma from platelets and dermapen using scar serum. Meanwhile, the dependent variable in this study was pockmarked on the skin surface of female Wistar rats (Rattus norvegicus).

Tools & Materials

The tools used in this study include; minor surgical tools (stainless steel tray, scalpel, blade, scissors, and tweezers), scales, dermapen 12 pins, sterile gloves, masks, 2 4 cc PRP tubes (Contains 3.8% sodium citrate), two sterile tubes without coagulants 4 cc, 10 cc syringe, 5 cc syringe, alcohol swab, centrifuge tool, plastic wrap, rat cage, feed container, ruler and stationery. While the materials used in this study included: the blood of female Wistar rats, scar serum, anesthetic (Ketamine), dextrose citrate, topical anesthetic cream (2.5% lidocaine and 2.5% prilocaine mixture), NaCl 0.9%, white rats, rat feed and drink.

Method

The research was carried out in several stages, from the preparation and testing stages. Starting from the Acclimatization of the Test Animals, then the Preparation of the Test Animals by shaving the hair around the pockmarked area of the rat (back part) according to the desired size (2×2 cm). Mice were anesthetized intramuscularly using a dose of 50 mg/kg of ketamine, weighed, and recorded their body mass/weight using an OHAUSS digital balance and expressed in grams.

Then the preparation of tools for PRP in the form of gloves, masks, 2 4 cc PRP tubes (containing 3.8% sodium citrate), two sterile tubes without coagulants 4 cc, 10 cc syringe, 5 cc syringe, alcohol swab, centrifuge tool. Preparation of rats that have been anesthetized. 5 cc of blood from each rat was taken using a needle given 0.7 cc of citrate dextrose and then shaken gently by turning the syringe back and forth until it was well mixed. The syringe has been modified to be inserted into the centrifuge by cutting the bottom and sides of the syringe and bending the needle.

Whole blood, once drawn, needs to have anticoagulants to prevent clotting. The PRP kit comes with a venipuncture tube that already contains an anticoagulant. This anticoagulant is citrate, which will bind to calcium ions, thereby disrupting the coagulation cascade. The blood is stable for up to 8

hours in the anticoagulant state.

The next step is centrifugation at 1700 rpm for 10 minutes to separate blood products into erythrocytes at the bottom layer, plasma which is a clear liquid on the top layer, and a thin white layer rich in platelets between plasma and erythrocytes which are called the buffy coat. Plasma was taken up to the buffy coat by cutting the tip of the syringe and connecting it to a new five-cc syringe. Second centrifugation was carried out at 3500 rpm for 10 minutes to precipitate platelets. 2 layers were formed in the form of plasma and pellet deposits at the bottom. 0.7 cc of plasma was discarded, and then the plasma and pellet were mixed using a syringe to make it homogeneous; then, calcium gluconate was added in the same amount as the plasma mixture.

Furthermore, the Implementation of Action and Observation began with cleaning the surface of the pockmarked rat skin with cleanser, then applying topical anesthetic cream and inclusion using plastic wrap for 45-60 minutes. Next, the Dermapen action procedure was carried out. Topical anesthetic cream is cleaned with 0.9% NaCl wet gauze. The pockmarked and marked parts of the mouse skin were given a dermapen action by making small wounds. The direction of movement of the needle is perpendicular to the stretched skin. Pressure is started point by point over all scars (2.5 mm needle depth), and the endpoint is the bleeding point. Any blood is wiped off with sterile gauze, and the skin is held in sterile saline. At the end of the procedure, a cold compress is applied for 5 minutes. Finally, perform data analysis using the SPSS program. The data normality test was analyzed using the Kolmogorov-Smirnov test approach. In order to see significant differences or comparisons between the test groups, it was analyzed using the t-test or the independent sample T-test approach.

3. RESULTS AND DISCUSSION

Table 1. Characteristics of Research Subjects

Component	P1 group	P2 group
Types of Rats	*Rattus norvegicus* wistar strain	
Sex	Female	
General Circumstances	White coat color, healthy and active	
Initial Mean Weight	200.0 gr	200.0 gr
Final Mean Weight	196.0 gr	196.8 gr

Table 2. Results of Healing Time of Cuts in Rats Until Healed (Days)

Replication	Treatment / Length of Healing Time (Days)	
	P1 group	P2 group
1	10	12
2	10	11
3	11	13
4	10	12
5	11	12
Mean	10.4	12

Table 2. shows that the PRP treatment of rats requires an average of 10.4 days to close the wound, which is faster than the group given scar serum. The group of rats given scar serum treatment took an average of 12 days to close the wound. This means there is a difference in the time needed for each rat to close the wound completely. The group given dermapen treatment with PRP needed a shorter time to complete the wound than the serum scar group.

Based on Table 3. The results of observations made in each group of PRP dermapen and serum scar dermapen treatment showed that there was a process of wound healing in white Wistar rats. The healing process can be seen from the length of the damage, which is getting less and less until it closes completely (wound length 0 cm). The table shows that the dermapen group using PRP has a superior acceleration of healing compared to the serum scar group. The PRP rat group achieved an average wound length of 0 cm on day 10.4, while the serum scar group achieved a wound length of 0 cm on day 12.

Table 3. Average wound length

Days to	Treatment Group/Repeat (cm)									
	PRP Dermapen Group					Dermapen Serum Scar Group				
	1	2	3	4	5	1	2	3	4	5
0	2	2	2	2	2	2	2	2	2	2
1	1.82	1.9	1.91	1.89	1.95	1.89	1.91	1.97	1.92	1.88
2	1.61	1.87	1.82	1.71	1.78	1.82	1.82	1.81	1.87	1.62
3	1.57	1.66	1.71	1.49	1.63	1.72	1.71	1.78	1.65	1.53
4	1	1.34	1.42	1.12	1.41	1.65	1.42	1.59	1.73	1.41
5	0.92	1	1.19	0.95	1.22	1.58	1.19	1.42	1.42	1.23
6	0.89	0.82	0.91	0.78	0.91	1.32	0.91	1.38	1.29	1.19
7	0.53	0.76	0.83	0.53	0.87	1.12	0.83	1.08	1.11	1
8	0.46	0.52	0.75	0.36	0.65	0.98	0.75	0.91	0.82	0.81
9	0.22	0.31	0.42	0.29	0.38	0.73	0.42	0.75	0.61	0.63
10	0	0	0.29	0	0.23	0.55	0.29	0.67	0.43	0.58
11	0	0	0	0	0	0.24	0	0.45	0.21	0.34
12	0	0	0	0	0	0	0	0.31	0	0
13	0	0	0	0	0	0	0	0	0	0
14	0	0	0	0	0	0	0	0	0	0

Based on Table 4, the normality test results have been carried out using the One-Sample Kolmogorov-Smirnov Test. The results obtained a significance of 0.200 for each group. The data is said to be normally distributed if the p-value> 0.05 [20]. Therefore, it can be concluded that the data is normally distributed.

Table 4. Normality Test Results

Tests of Normality

		Kolmogorov-Smirnov[a]		
	Variable	Statistic	df	Sig.
Result	PRP	.160	15	.200*
	Scar Serum	.119	15	.200*

*. This is a lower bound of the true significance.
a. Lilliefors Significance Correction

Table 5. Homogeneity Test Results

Test of Homogeneity of Variances

		Levene Statistic	df1	df2	Sig.
Result	Based on Mean	.026	1	28	.874
	Based on Median	.014	1	28	.906
	Based on Median and with adjusted df	.014	1	27.627	.906
	Based on trimmed mean	.022	1	28	.884

In Table 5, the probability value in the significance column is 0.874 > 0.05 [9], so it can be concluded that the PRP dermapen group and the serum scar dermapen group come from populations with the same variance, or both groups are homogeneous

Table 6. T-test results

Independent Samples Test									
	Levene's Test for Equality of Variance		t-test for Equality of Means						
Result in Equal variances	F	Sig.	t	df	Sig. (2-tailed)	Mean Diff.	Std. Error Diff.	95% Confidence Interval of the Difference	
								Lower	Upper
Assumed	.026	.876	-.679	28	.503	-.1820	.2681	-.7313	.36726
Not assumed			-.679	27.96	.503	-.1820	.2681	-.7313	.36729

In Table 3, it can be seen that the probability value (sig.2-tailed) with the t-test is 0.503. The significance value obtained was greater than 0.05, so H0 was accepted, or the wound healing in the two groups was not significantly different [9].

Discussion

This study was conducted to test the research hypothesis, namely whether there is a comparison of the effectiveness of the action of dermapen using plasma from platelets with the movement of dermapen using scar serum on pockmarked areas on the surface of the skin of female Wistar rats (Rattus norvegicus). One of the skin disorders or problems that often gets attention is pockmarks, namely scars that leave a texture on the skin. Pockmarks can damage the appearance, so most people try to remove spots from their skin. Various ways can be done to eliminate pockmarked wounds, including using the skin needling therapy method with dermapen.

The principle of action of this dermapen is to make a skin wound so that anesthesia is needed and done in a sterile manner. Dermapen action can be combined with various active ingredients to stimulate new collagen formation further. The dermapen action can be combined using plasma from platelets, platelet-rich plasma (PRP), or scar serum. Researchers suspect that there is a comparison of the effectiveness of dermapen using platelet plasma (PRP) with dermapen using scar serum on pockmarked skin areas. So, a trial was carried out on female Wistar strain white rats to prove this conjecture.

The research was conducted by collecting data relating to the observation of treatment procedures. The collected data is then processed to test the normality of the data. From the results of the data normality test, it was found that the data were normally distributed, which means that the data is representative and can represent the population. After that, a homogeneity test was carried out to see the variance of the subjects. The results showed that the PRP dermapen group and the serum scar dermapen group came from populations with the same conflict, or both groups were homogeneous. The last t-test was performed to see the significance value. The significance value obtained was greater than 0.05, so H0 was accepted, or the wound healing in the two groups was not significantly different. So, the two dermapen PRP and serum scar groups did not differ significantly.

The results showed that using PRP and scar serum can induce wound healing function. The PRP group was seen from the average acceleration of healing, which was faster than the serum scar group. This can happen because PRP has bioactive molecules known to be productive as growth factors in tissues so that they can increase the proliferation rate. It is explained that the composition of PRP contains many important growth factors for wound healing. These results are supported by reports stating that PRP can stimulate wound healing and tissue regeneration [21]. Meanwhile, scar serum contains concentrates that are useful for nourishing and moisturizing the skin, which can easily penetrate the deepest layers of the skin, thereby accelerating skin regeneration.

4. CONCLUSION

Based on observations and data analysis that has been done, it can be concluded that dermapen treatment using PRP and scar serum is effective in stimulating the healing of pockmarked wounds. PRP was more effective in accelerating skin regeneration than scar serum, with an average healing time of 10.4 days and 12 days. This can be seen in the PRP dermapen treatment group, which was

superior in closing skin needling wounds compared to the serum scar dermapen group. The results of wound observations based on the period (days) needed by each rat to close the wound in the PRP dermapen group were faster than the serum scar group. This can be explained by the PRP content containing growth factors important for wound healing and tissue regeneration, thus accelerating healing.

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