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Dermapen Treatments for Healing Pockmarked Skin in Male Wistar Rats (*Rattus norvegicus*): A Study Comparing Platelet-Rich Plasma with Salmon DNA Serum

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Abstract: Skin issues like deep acne scars (pockmarks) are routinely addressed. Dermaroller and Dermapen face skin care help cure this issue. Researchers believe plasma from platelets (PRP) and salmon DNA serum dermapens work similarly on pockmarked skin. White Wistar mice were tested to confirm this suspicion. This is a lab study or an experiment. The study employed a post-test only with a control group design on 16 white Wistar rats (*Rattus norvegicus*) divided into two groups of eight rats each: Group I received platelet plasma dermapen (PRP) and Group II received salmon DNA serum dermapen. The collected data was tested for normalcy using SPSS. The data normality test showed a significance value of 0.20 > 0.05, indicating normal distribution. The homogeneity test is 0.224. The significant probability value is greater than 0.05, indicating that the PRP dermapen group and the salmon serum DNA dermapen group have similar variances. The t-test rejects H0 or shows a significant difference in wound healing between groups if the significance value is 0.00 or less than 0.05. The study found that PRP and salmon DNA serum promote wound healing. Healing was faster in the PRP than in the salmon DNA serum group. This is possible because PRP includes bioactive molecules that act as tissue growth factors to enhance proliferation. PRP contains various growth factors that aid wound healing.

Keywords: Acne scar; Platelet-rich plasma; Pockmarked skin; Salmon DNA serum

Introduction

The skin is the body's protective barrier between itself and the outside world. The skin's protective role extends to the mucous membrane that lines the body's internal cavities and openings. In addition to assisting with thermoregulation and water loss control, the descending neurons also participate in excretion, secretion, and absorption (Lim et al., 2022). The human face is the most striking feature, regardless of gender. Taking care of one's skin might boost one's self-esteem. Intense and consistent care, particularly for the face, is required for good skin. Facial skin care is essential, especially for those who spend much time out of the house. Air pollution, makeup residue, and other irritants can cause skin issues and disease (Aslam et al., 2021; Bilal et al., 2020; Khalid & Riaz, 2021).

Acne (acne vulgaris) is one of the skin conditions that can arise (Castillo & Keri, 2018). Acne occurs when oil and dead skin cells obstruct the pores, leading to the formation of inflammatory pustules (Chilicka, 2021; Saadawi et al., 2018). More than 80% of the population between 12 and 44 has experienced acne. Acne is most common during puberty (age 8–9), when a surge in androgen hormone production causes an outbreak of sebum keratin (Chalabi et al., 2020). Acne is defined by blackheads, papules, pastures, and scars on the face, neck, upper arms, chest, and back and is caused by a blockage in the pilosebaceous. The acne bacteria Propionibacterium acnes, Staphylococcus epidermidis,

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and Staphylococcus aureus contribute to acne inflammation (Fourni et al., 2020; Jusuf et al., 2022).

Around 85% of people get acne (Acne vulgaris), especially as children. The highest occurrence is 83-85% in women aged 14-17 and 95-100% in men aged 16-19. An estimated 80% of teens have this illness, which causes blackheads, papules, pustules, nodules, scar tissue, and other appearance issues (Shannon, 2020). Pockmarked facial skin is another skin and facial condition besides acne. Skin issues like deep acne scars (pockmarks) are routinely addressed. Acne scars generate deep skin depressions called pockmarks. Acne and smallpox scars rarely fade. This syndrome causes skin indentations because skin cells cannot make enough collagen to cover scars (Juhasz & Cohen, 2022).

Pockmarks result from poor wound healing. Atrophic acne scars result from collagen degradation after inflammatory acne. Genetics, acne severity, inflammatory acne lesion duration, delayed and incorrect therapy, and excoriation are the key scar-forming variables (Casabona, 2018; El-Taieb et al., 2019; Long et al., 2020; Rana et al., 2017). Pockmarks often result from pressing pimples with filthy hands (Tan et al., 2022). Skin disorders like acne scars can also induce emotional weakness, embarrassment, low self-esteem, and social isolation. Subcision, dermabrasion, chemical peels, lacerations, fat grafting, and dermal fillers can treat acne scars. These methods work, but they have drawbacks (Fabbrocini et al., 2010). For hyperpigmented skin disorders like spots and pockmarks, facial skin care with technology can yield faster results. Microneedle therapy is ideal for facial skin issues. If you use cosmetics that suit your skin and handle it properly, microneedle therapy in facial care can yield ideal results (Juhasz & Cohen, 2020; Saadawi et al., 2018).

Scar treatment using microneedles is novel. Especially acne scars, wrinkles, dyschromia, melasma, enlarged pores, and face rejuvenation. Microneedling boosts collagen and elastin production, which gives skin a youthful appearance. The goal is to cause controlled damage to increase collagen production in the treated area, for its potential to stimulate skin cell growth. A firm, smooth, and elastic complexion is maintained by collagen, an essential protein (Alster & Graham, 2018; Iriarte et al., 2017; Sitohang et al., 2021). Microneedle therapy can repair UV damage, discoloration, and melasma hyperpigmentation by stimulating collagen formation (Chalabi et al., 2020; Juhasz & Cohen, 2022).

Dermaroller and dermapen are the two micro needle therapy system tools. Recently, Dermapen has become a popular acne scar treatment and skin rejuvenation method due to its low cost, few problems, and fast healing. Dermapen promotes acne scar reformation by synthesizing collagen and elastic tissue with minimal epidermal harm (Alster & Graham, 2018; Gowda et al., 2021). Dermapen microneedling has been studied extensively, although few have shown its efficacy in severe atrophic acne scars and dark skin (Castillo & Keri, 2018; Chalabi et al., 2020; Eve Sonenblum et al., 2023; Lim et al., 2022).

Dermapen is a motorized pen-shaped micro needle therapy equipment that may be customized to treat skin issues. Dermapen adjusts needle depth from 0.25 to 2 mm collagen induction therapy. The best outcomes from dermapen depend on the individual skin's natural regeneration process. Thus, three to five treatments spaced four to six weeks apart are recommended. Time is needed for skin cells to change over and generate collagen (Amer et al., 2018; Chalabi et al., 2020; Mohamed et al., 2023; Salman & Mohammed, 2020). Platelet-rich plasma (PRP) can treat acne scars by speeding wound healing and tissue restoration. PRP Therapy, or the Vampire Facial, rejuvenates skin. It is termed the Vampire Facial because it uses patient blood. The Vampire Facial employs one's blood plasma with high platelet concentration to improve soft and hard tissue healing and minimize wound healing time (Gowda et al., 2021; Juhasz & Cohen, 2020, 2022).

PRP is plasma with large platelet concentrations. PRP consists of 1,000,000 platelets/µL of autologous blood plasma from the patient. PRP can enhance healing with high platelet concentrations and complement clotting factors (average platelet count 150,000-350,000/µL) (Gentile et al., 2020; Kelm & Ibrahim, 2022; Peng, 2019). PRP treats ulcers, facial rejuvenation, acne scars, periorbital hyperpigmentation, alopecia areata, and androgenic alopecia, as well as wound healing, scar management, skin resurfacing and rejuvenation, hair loss (alopecia), fat grafting, and soft tissue volume augmentation (Hesseler & Shyam, 2019; Long et al., 2020; Peng, 2019; Rohmah, 2021; Roohaninasab et al., 2021).

They are centrifuging platelet-rich plasma yields PRP. PRP platelets are 20 times more protein-rich than blood platelets. PRP contains bioactive compounds that function as tissue growth factors, which increase proliferation (Čoma et al., 2021; Nakai & Tsuruta, 2021; Röhl et al., 2015; Schmitt et al., 2018). PRP is an autologous physiologically active blood component rich in growth factors, cytokines, and plasma proteins. PRP contains growth factors, chemotactic agents, and vasoactive agents that aid regenerative regeneration (Christi & Harwoo, 2020; Kolimi et al., 2022; Shannon, 2020).

The platelet concentration in PRP is 2–6 times that of whole blood. PRP works because platelets are physiological sensors of growth factors and have healing capabilities that regenerate tissue (Tottoli et al., 2020).

Modern treatments like PRP repair wounds, rejuvenate skin, alleviate hair loss, and treat bone problems. Centrifuged whole blood yields growth factor-rich PRP (Amable et al., 2013; Everts et al., 2006; Kelm & Ibrahim, 2022). According to the background above, dermapen microneedling therapy can increase acne scar remodeling, and platelet-rich plasma (PRP) can treat various diseases, including acne scars. Based on this, this researcher will conduct laboratory research to compare the efficacy of plasma derma pen from platelets and salmon DNA serum derma pen on the pockmarked skin surface of male Wistar strain rats (*Rattus norvegicus*).

Method

Laboratory experimental research or genuine experiment is research conducted in a lab, study center, or artificial environment (Notoatmodjo, 2018). The research uses solely a post-test with a control group design. This study used 160-200-gram adult Wistar strain white rats (*Rattus norvegicus*) aged 2-3 months. This study used 16 white rat samples, separated into two groups of eight animals each: Group I received platelet plasma dermapen (PRP) treatment, and Group II received salmon DNA serum dermapen treatment. In in vivo research, the "3R Principle" (Replacement, Reduction, and Refinement) requires researchers to minimize the number of animals employed without compromising results (MacArthur Clark, 2018).

The hypothesis (temporary conclusions or conjectures) of a study is tested using variables to determine if current theories and empirical data are compatible (Suwarno & Nugroho, 2023). This study examined dermapen activity with PRP and salmon DNA serum as independent factors. This study's dependent variable was male Wistar rat's (*Rattus norvegicus*) skin pockmarks, and the precondition variable was dermapen wounds on their backs. Test animals were acclimatized in the Animal House, Faculty of Mathematics and Natural Sciences, University of North Sumatra, for one week. To prepare test animals, shave the mice's back hair to the desired area (2x2 cm).

Dermapen wounds were created on test animals and treated with PRP and salmon DNA serum. The mice's pockmarked skin was cleaned using cleaner; then, the dermapen process was performed for group I mice given PRP and group II mice given Salmon DNA serum. Research data was evaluated using SPSS. The Kolmogorov-Smirnov test ($p > 0.05$) assessed data normality. Trials were assessed using t-test or independent samples T-Test ($p < 0.05$) to determine group comparison significance.

Result and Discussion

Result

This study used 16 160-200-gram Wistar white rats. Platelet-rich plasma (PRP) and salmon serum DNA dermapens were compared in this study. This dermapen treatment wounds the rat's shaved back. Puncture of the dermapen needle causes wounds. After the wound formed, the rat rested for a day to form a pockmark. The next day, group 1 received PRP dermapen, and group 2 received salmon DNA serum to test which healed pockmarked lesions better. PRP and salmon DNA serum were given daily for 14 days. The wound was monitored daily for 14 days. The average wound length was measured daily from the first day of therapy to the 14th day to observe the Wistar white rats (*Rattus norvegicus*) wound healing.

Table 1. Results of Long Rat Cut Wound Healing Time

Repetition	Group P1 (PRP Dermapen Therapy)	Group P2 (Salmon Serum DNA)
1	8	13
2	9	12
3	8	13
4	7	12
5	10	12
6	8	14
7	9	11
8	10	13
Mean	8.6	12.5

Table 2. Results of Mean Wound Healing

Days	Size (cm)		Percentage (%)	
	PRP	DNA Salmon	PRP	DNA Salmon
1	2	2	0	0
2	1.895	1.913	5.5	4.5
3	1.630	1.800	18.5	10
4	1.365	1.669	32	17
5	1.049	1.508	48	25
6	0.868	1.301	57	35
7	0.625	1.160	69	42
8	0.299	0.978	85	51.5
9	0.099	0.785	95	61
10	0.039	0.606	98	70
11	0	0.458	100	77.5
12	0	0.249	100	88
13	0	0.099	100	95.5
14	0	0.01	100	99.5

Researchers monitored rats' wounds daily and measured their length with calipers. Macroscopic monitoring can reveal scars, which emerge after wound healing matures. The dermapen-containing PRP and salmon DNA serum groups were compared for wound healing. The dermapen and salmon DNA serum-treated pockmarked wounds were observed daily at 16.00 WIB until completely healed. Table 1 shows that each rat

needed different times to repair the incision. Dermapen with PRP closed wounds faster than salmon DNA serum.

The mean length of pockmarked wounds in white mice was measured daily from the first day to the 14th day to assess healing. Table 2 shows in each PRP and salmon serum DNA group that white Wistar rats repair cuts. The two groups had different healing rates. Pocked wounds in the PRP group healed 100% on the 10th day and in the salmon DNA serum group on the 14th. The PRP group healed faster than the salmon DNA serum group.

Table 3. Normality Test

		Kolmogorov-Smirnov[a]		
	Group	Statistic	df	Sig.
Result	PRP	.177	8	.200*
	Salmon Serum DNA	.188	8	.200*

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

According to Table 3, the One-Sample Kolmogorov-Smirnov Test determined normalcy. The results were significant at 0.200 for each group. A p-value > 0.05 indicates regularly distributed data. This implies that the data is normally distributed.

Table 4. Homogeneity Test of Variances

	Levene Statistic	df1	df2	Sig.
Based on Mean	1.620	1	14	.224
Based on Median	1.642	1	14	.221
Based on the Median and with adjusted df	1.642	1	12.905	.223
Based on trimmed mean	1.619	1	14	.224

Table 4 shows Levene's homogeneity test results in Table 6, with a significance column probability of 0.224. Since the significance probability value is more significant than 0.05, the PRP dermapen group and the salmon serum DNA dermapen group are homogeneous or have the same variance.

Table 5. T-Test

Independent Samples Test						
Levene's Test for Equality of Variances		t-test for Equality of Means				
F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference
1.620	.224	-7.657	14	.000	-.33375	.04359

Based on Table 5, it can be seen that the probability value (sig.2-tailed) with the t-test is 0.000. The significance value obtained is smaller than 0.05, so H0 is rejected, or the healing of pockmarked wounds in the two groups is significantly different.

Discussion

Facial skin is the body's outermost organ and affects appearance. Face pockmarks are common. Skin issues like deep acne scars (pockmarks) are routinely addressed. Acne scars generate deep skin depressions called pockmarks. This research tested whether platelet plasma and salmon DNA serum dermapens repair Wistar strain rats' pockmarked skin. Lack of collagen during wound repair causes pockmarks, depressions, and holes that create uneven facial skin. Technology-based facial skin care can help treat this issue faster. Microneedle therapy is ideal for facial skin issues. If you use cosmetics that suit your skin and handle it properly, microneedle therapy in facial care can yield ideal results.

Dermaroller and dermapen are the two micro needle therapy system tools. Recently, Dermapen has become a popular acne scar treatment and skin rejuvenation method due to its low cost, few problems, and fast healing. Dermapen promotes acne scar reformation by inducing collagen and elastic tissue synthesis with minor epidermal damage. Based on these findings, researchers want to see if dermapen can repair pockmarked wounds. Researchers believe plasma from platelets (PRP) and salmon DNA serum dermapens work similarly on pockmarked skin. White Wistar mice were tested to confirm this suspicion.

Data from treatment procedures was collected for the study. The collected data is processed to test its normalcy. The data normality test showed a significance value of 0.200 > 0.05, indicating that the data is normally distributed and typical of the population. Homogeneity testing was then performed to determine subject variance. The significance level is 0.224. The significant probability value is greater than 0.05, indicating that the PRP dermapen group and the salmon serum DNA dermapen group have similar variances. Finally, a t-test determines significance. If the significance value is 0.000 or less than 0.05, H0 is rejected, or wound healing differs between groups.

The results demonstrated that PRP and salmon DNA serum could promote wound healing. Healing was faster in the PRP than in the salmon DNA serum group. This is possible because PRP includes bioactive molecules that act as tissue growth factors to enhance proliferation. PRP contains various growth factors that aid wound healing (Bai et al., 2020; Peng, 2019; Tottoli et al., 2020). Reports have shown that PRP can speed up the healing process and promote tissue regeneration, consistent with these findings. Salmon DNA serum has a concentrate that helps nourish and moisturize the skin and can readily penetrate deep into the skin to speed up the regeneration process (Čoma et al., 2021; Graça et al., 2020; Sahu et al., 2021; Tottoli et al., 2020).

Conclusion

It has been observed and analyzed that dermapen therapy, including platelet-rich plasma (PRP) and salmon DNA serum, successfully accelerates the healing of crater-like lesions. PRP and salmon serum DNA groups healed pockmarked lesions differently, as indicated by a t-test result of 0.000 or 0.05. Compared to salmon DNA serum, PRP has been shown to speed up the skin-regeneration process significantly. This is evidenced by the fact that the PRP dermapen therapy group had quicker wound healing than the salmon DNA serum dermapen treatment group. The wound observation data showed that the PRP dermapen group healed faster than the salmon DNA serum group by a margin of days. This is because PRP contains growth factors necessary for wound healing and tissue regeneration, which causes the healing process to move along more quickly. The outcomes of this study should shed more light on how helpful dermapen is for speeding up wound healing and skin regeneration. More research is needed to compare the dermapen action using platelet plasma to the dermapen action using salmon DNA serum in human subjects, and more microscopical research, such as histopathological research of skin tissue to check the amount of collagen and fibroblasts, is also needed.

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Author Contributions
Linda Chiuman and Hestina conceptualized the research idea, designed of methodology, management and coordination responsibility; Nicolas Xavier Ongko analyzed data, conducted a research and investigation process; Setia Budi Tarigan conducted literature review and provided critical feedback on the manuscript.

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Conflicts of Interest
The author declared no conflict of interest.

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