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Compare the Effectiveness of a Peel-Off Mask and Sheet-Mask with Green Tea Extract on Dermapen-Treated Wounds on the Back Surface of Female Wistar Rats

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Abstract

Microneedling has recently been cited as having high efficacy, safety, and recovery rates post-treatment. This microneedling procedure has shown results that increase patient satisfaction and awareness of doctors who want minimal treatment but still get maximum results for healing uneven skin on the face and acne scarring. The test and analysis of the difference in effectiveness between the use of a peel-off mask and a sheet mask in healing wounds treated with derma pen on the surface of the back skin of female Wistar rats (Rattus norvegicus). This research approach uses experimental quantitative research methods, namely an actual experiment or laboratory experimental design. They used a pre-test – post-test control group design to determine and analyze the differences or comparisons in the effectiveness of using a peel-off mask and a sheet mask for wounds treated with a derma pen on the skin surface. The research subjects were 10 female Wistar rats (Rattus norvegicus). The research procedure was the acclimation of test animals, phytochemical screening, treatment, and observation carried out on mice by administering dermapen wounds. The research data was analyzed using the SPSS program. In this study, Wistar strain white rats (Rattus norvegicus) with peel-off and sheet masks healed their wounds. Dermapen wounds heal after 14 days, as the average rat wound length shows. The peel-off mask group healed 100% on day 13, while the sheet-mask group healed 100% on day 12. Based on this percentage difference, the researchers found that the group with the fastest wound healing used a 12-day green tea sheet mask.

Introduction

The growth of dermatological technology is fascinating. This development led to minimally invasive facial and body operations that heal various ailments with few problems and recovery times. With so many dermatological procedures available, patients want cutting-edge health and appearance care. Access to procedures and diagnosis are increasing success rates. Microneedling is a technique that has been discussed extensively for this aim (Iriarte et al., 2017; Mohamed et al., 2023). Microneedling, or percutaneous collagen induction therapy, is a minimally invasive procedure that involves inserting fine needles into the skin, generally via stamping, derma roll, or derma pen (Alster & Graham, 2018).

The resulting microinjury upregulates genes involved in epidermal differentiation and tissue remodelling in vitro. Furthermore, microneedling can facilitate transdermal medications. Microneedling has recently been cited as having high efficacy, safety, and recovery rates post-treatment. These microneedling results have increased patient satisfaction and physician

awareness of this popular procedure. This significant increase in minimally invasive procedures shows that microneedling is preferred by patients who want minimal treatment but still get maximum results. Microneedling has become an integral part of the daily grooming algorithm and has dramatically changed the approach to correcting uneven facial skin tone and acne scarring (Alster & Graham, 2018; Gowda et al., 2021; Iriarte et al., 2017; Long et al., 2020; Peng, 2019). Due to its low cost and easy treatment compared to ablative and non-ablative laser therapy, this method is becoming increasingly popular, and research in this area is intensifying (Gowda et al., 2021; Kang & Lu, 2022; Sitohang et al., 2021).

The minimally invasive cosmetic technique of microneedling boosts blood circulation. It usually improves scars and boosts collagen. Scars, rhytides, and dyschromia can be treated with microneedling. Needle punctures create tiny epidermal and dermal damage pathways in this treatment. Removing damaged collagen promotes growth and remodelling. Platelet-derived growth factors, fibroblasts, and elastic fibres support neovascularization and neocollagenesis. This improves scars, especially atrophic ones (Juhasz & Cohen, 2020; Kang & Lu, 2022; Schoenberg et al., 2020).

A regulated mechanical stimulation of the wound healing response, microneedling involves initiation/inflammation, proliferation, and remodelling. In the first phase, platelets and neutrophils recruited to the injury site release growth factors like TGF-a, TGF-b, and platelet-derived growth factors, which promote intercellular matrix protein production and propagation. Growth factors affect monocytes, keratinocytes, and fibroblasts in the second phase. Fibroblasts deposit collagen into a fibronectin matrix. In the third phase, collagen converts into collagen I through tissue remodelling and vascular maturation, tightening the skin. Dermastamp, dermaroller, and Dermapen are commercial microneedling devices (Juhasz & Cohen, 2020; Saadawi et al., 2018; Schoenberg et al., 2020).

The small handheld wheel with a needle on the derma roller punctures the skin to induce collagen, enhance texture, diminish acne scars, and product penetration. Dermapen's form controls microneedling penetration in the skin. Spring-loaded fractional microneedling device Dermapen has an adjustable ring to modify microneedle height. An electrically powered pen vibrates stamp-like on the skin to create micro-channels. Demastamps are stamps with 0.8- or 2.1-mm stainless steel needles. Squeeze the scar 3-4 times and create 200-300 holes in a 1 cm2 region. Derma stamping rips and rearranges scar tissue's thick collagen fibres and fibroblasts (Saadawi et al., 2018).

Microneedles create controlled skin wounds without harming the epidermis. Microinjuries induce minimal bleeding and initiate a healing cascade by releasing growth factors like platelet-derived growth factor, TGF-α and TGF-β, CTAP, CTGF, and FGF. Microneedling is less intrusive and can be done under local anaesthetic, which is its principal benefit. Microneedling reduces post-procedural bleeding, edema, and pain by preserving the epidermis. This impact persists and varies by person. Microneedling is well-tolerated, but erythema and edema last 2-3 days. Erythema is a reddish patch on the skin caused by blood vessel enlargement (Eve Sonenblum et al., 2023). Edema is swelling caused by interstitial fluid expansion in tissues or organs (Haydinger et al., 2023). Therefore, aftercare is needed to speed recovery and improve results. Using a wound dressing or mask is one way.

Microneedling causes hot, red, sunburn-like skin and maybe bleeding. Therefore, aftercare is needed to speed recovery and improve results. You can use a wound treatment or bandage. Wet dressings speed wound healing more than dry ones. Wet conditions are necessary for skin rejuvenation without inflammation and eschar development. Thus, wet dressings are suitable for wound dressing. A good wound dressing should control moisture sound gas transmission, remove excess exudate, protect the wound from infections and microorganisms, reduce wound surface necrosis, have mechanical protection, be easy to change and straightforward, be

biocompatible, biodegradable, elastic, and non-toxic, relieve wound pain, and be affordable. Several peptides, antioxidants, and growth factors increase collagen production (Rezvani Ghomi et al., 2019).

Depending on the contents and purpose, masks hold moisture or ingredients in the skin and moisturize, hydrate, dry, or exfoliate. Facial masks help substances permeate the skin faster. Facial masks can deliver more salicylic acid for acne, vitamin C for fine wrinkles, or retinoids for dark spots than conventional methods (Nilforoushzadeh et al., 2018; Paichitrojjana, 2021). Masks are creams, ointments, lotions, serums, or sheets that deliver "active ingredients" to the skin to immediately improve its appearance and condition. This cosmetics category is packaged differently and contains different substances dependent on skin types, such as clay and mud masks for oily skin and cream-based masks for dry skin (P et al., 2019; Paichitrojjana, 2021). Other gel and fibre masks include peel-off and sheet-mask.

Peel-off masks are high-quality powder masks used for beauty salon treatments. Use this mask on the face, neck, collar, and hands. The impermeable horn layer underlying the elastic mask material gathers moisture as the mask hardens. After application and drying, polyvinyl alcohol (PVA) peel-off masks form an occlusive layer on the face. This mask cleanses, tensors, and moisturizes the stratum corneous by eliminating dead cells, residue, and other contaminants. The skin smooths, and elasticity increases after one treatment. Patients who cannot take oral antibiotics can use peel-off masks. Peel-off removes blackheads and dead skin. It tightens and treats wrinkles.

Dry and moist sheet masks exist. The wet mask is blended with natural or chemical components and applied to the face after opening the container. This mixture contains preservatives, emulsifiers, and other compounds (Paichitrojjana, 2021). Depending on skin demands, sheet mask ingredients vary. Water is the most essential element, but other ingredients assist in bonding it to the skin. Based on needs, these ingredients should contain moisturizers, skin brighteners, proteins, vitamins, anti-wrinkle compounds, minerals, and uncommon ingredients like seaweed, hyaluronic acid, etc (P et al., 2019).

Hyaluronic acid, a non-sulfated glycosaminoglycan (GAG), is a crucial skin extracellular matrix (ECM) component implicated in inflammation, angiogenesis, and tissue regeneration. Sponge, film, hydrogel, and electrospun membrane wound dressings have been made from HA due to their biocompatibility, biodegradability, and hydrophilicity (Graça et al., 2020). Researchers are searching for novel substances that positively impact skin care with safe, incredibly active, and high-quality ingredients (Asadi et al., 2013). Green tea (Camellia sinensis) and its active components are extensively used in skin care and skin treatment products because of their abundance of bioactive compounds—many compounds are used for wound healing, such as acetic acid, hydrogen peroxide, etc. The most effective fermentation time and dose of bio-extract suggest improvements in bioactive compounds for use in skin care formulations. Green tea extract could help wound healing and is probably effective in surgical recovery (Makhamrueang et al., 2023).

Hyaluronic acid is a tremendous post-microneedling treatment. Since the body naturally produces this acid, there is no risk of irritation or response. An excellent hyaluronic acid serum reduces inflammation, calms redness, stimulates fibroblasts, collagen, and elastin formation, and hydrates skin after treatment. Based on this background explanation, Researchers are interested in knowing and testing the difference in effectiveness between the use of a peel-off mask and a sheet mask with green tea extract (Camellia sinensis) in healing wounds treated with dermapen on the surface of the back skin of female Wistar rats (Rattus norvegicus).

Methods

This research uses an experimental quantitative analysis, namely an actual or laboratory experimental design. A true experiment is empirical research carried out seriously by

controlling all external variables that can influence practical activities (Notoatmodjo, 2022). This study used a pre-test – post-test control group design to determine and analyze the differences or comparisons in the effectiveness of using a peel-off mask and a sheet mask for wounds treated with dermapen on the surface of the back skin of female Wistar rats (Rattus norvegicus).

Female Wistar rats (Rattus norvegicus) weighing 160-200 grams and 2-3 months old were used in this study. Researchers recruited female Wistar rats as test subjects because they have traits and physiologies similar to humans and are commonly employed in biomedical research. These mice are bigger and better at lab adaptation than mice. The research sample number is determined by applying the 3R Principle (Replacement, Reduction, and Refinement), specifically Reduction (Kendall et al., 2018). All 10 female Wistar rats (Rattus norvegicus) in the study will be separated into four groups. Group A received a dermapen and a peel-off mask, while Group B received a dermapen and a sheet mask. Each group comprised 5 animals.

This research consists of independent and dependent variables (Suwarno & Nugroho, 2023). The independent variables in this study were the use of peel-off masks and sheet masks. Meanwhile, the dependent variable is wound healing from dermapen on the back surface of female Wistar rats (Rattus norvegicus). The Precondition Variable is Dermapen Action, the Independent Variable (X) is Peel-off Mask and Sheet-Mask, and the Dependent Variable (Y) is Dermapen Wound Healing.

The first research procedure carried out was the Acclimation of Test Animals, namely ten Wistar females who went through an acclimatization process for seven days—making Green Leaf Tea Extract (Camellia sinensis), then Phytochemical Screening to test the Tannin, Flavonoid, Alkoloid, Steroid/Terpenoid and Saponin Content—then making Peel-Off Masks and Sheet-Mask. Next, the dermapen procedure is carried out. Lastly, treatment and observation were carried out on mice by administering dermapen wounds. The part of the rat's skin that has been shaved is given a dermapening action by inserting a microneedle, which will create tiny wounds. Observations were carried out on all groups using a macroscopic method, namely, using a calliper to measure the wound length, which was carried out every two days. The research data was analyzed using the SPSS program.

Result and Discussion

Description of Research Subjects

Ten Wistar white rats weighing 190-200 grams were studied. Most female white Wistar (Rattus norvegicus) strain mice in this study were healthy before and after treatment. Pre-treatment mice weighed 190 grams in the peel-off group and 192 grams in the sheet-mask group. After the therapy, the mice were weighed again and only lost a little weight, indicating that they stayed healthy during the study. Then, the researcher started treatment. Mice receive dermapen wounds to start treatment. Before wound treatment, 50 mg/kgBB ketamine knocked the mice out of consciousness so they didn't feel pain or move. After losing consciousness, shave the back area to achieve a clean, bald appearance in the desired wound area (2x2cm). Tiny needles in the dermapen instrument penetrate, causing inflammatory wounds that require wound care.

Figure 1. Research Subjects and Process of Manufacturing Treatment in the Form of Wounds Caused by Dermapen

Phytochemical Screening Results

This study examined two wound treatments. In the first group, a peel-off mask with green tea extract was applied. Green tea sheet masks were given to the second group. The researchers first performed a phytochemical test on the green tea extract to determine its secondary metabolite compounds, which can speed up dermapen wound healing on white rats (Rattus norvegicus) Wistar strain.

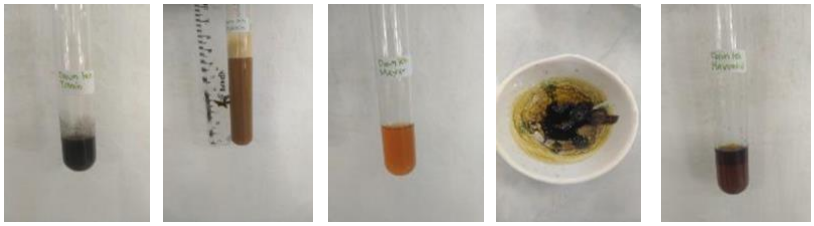

Figure 2. Phytochemical Results

Phytochemical testing was conducted to examine the content of secondary metabolite compounds in green tea extract (Camellia sinensis). Phytochemical tests include flavonoids, saponins, tannins, alkaloids, and steroids/triterpenoids. The results of the phytochemical test found foam in the green tea extract, which means it positively contains saponins. The alkaloid test result is yellow, which means it is positive for containing alkaloids. The colour of the steroid/triterpene test results is green, which means it is positive for steroids. Table 1 shows that the results of wound treatment caused by dermapen on mice were carried out once a day, namely at 09.00 AM for 14 days. Wound healing in mice was observed by measuring the average surface area of the wound every day, starting from the first day the wound was made using a derma pen until the 14th day using a calliper.

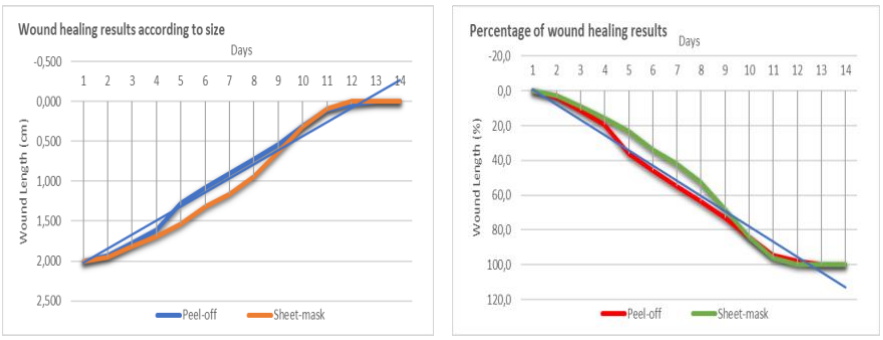

Figure 3. Results of Wound Healing by Size and Percentage

The observations made on all groups show both groups experienced complete wound closure. The difference was in the length of healing; the peel-off group experienced 100% wound healing on the 13th day, while the sheet-mask group was on the 12th day.

Table 1. Normality Test

Tests of Normality

		Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Groups	Statistic	df	Sig.	Statistic	df	Sig.
Result	Peel-off	.209	5	.200*	.877	5	.294
	Sheet-mask	.233	5	.200*	.908	5	.457

*. This is a lower bound of the true significance.

a. Lilliefors Significance Correction

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Based on the normality test results, which were carried out using the One-Sample Kolmogorov-Smirnov Test. The results obtained were significant at 0.200 for each group. Data is said to be normally distributed if the p-value is > 0.05. Therefore, it can be concluded that the dermapen wound healing data is usually spread. Based on the results of the homogeneity test using the Levene test in the table above, it can be seen that the probability value in the significance column is 0.063. Because the significance probability value is more significant than 0.05 (p>0.05), it can be concluded that the peel-off and sheet-mask groups come from populations with the same variance; the group is homogeneous. In the t-test table, it can be seen that the probability value (sig.2-tailed) with the t-test is 0.101. The significance value obtained is more significant than 0.05, so H0 is accepted, or there is no significant difference in dermapen wound healing between the peel-off and sheet-mask groups.

Table 2. Homogeneity Test

Test of Homogeneity of Variances

		Levene Statistic	df1	df2	Sig.
Result	Based on Mean	4.648	1	8	.063
	Based on Median	1.506	1	8	.255
	Based on Median and with adjusted df	1.506	1	6.638	.262
	Based on trimmed mean	4.414	1	8	.069

Table 3. t-Test

Independent Samples t-Test

		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
Result	Equal variances assumed	4.648	.063	-1.856	8	.101	-.08200	.04418	-.18388	.01988
	Equal variances not assumed			-1.856	6.178	.111	-.08200	.04418	-.18936	.02536

This research aims to test the research hypothesis, namely whether there is a difference in the effect of giving a peel-off mask and a sheet mask on accelerating the healing process of dermapen scars on the surface of rat skin. This research used the Wistar strain's ten white rats (Rattus norvegicus) divided into 2 test groups. Before starting the study, the mice were first weighed. The average body weight of the mice before the test was carried out was 201 grams. At the end of the study, the mice were weighed again, and an average result of 198.25 gr per test group was obtained. Based on these results, it can be concluded that the body weight of the mice before and after the study did not change significantly. Next, observations were made on wound healing.

A wound, by definition, is a disintegration in the skin's barrier function (Sorg et al., 2017). Loss of epithelial cohesiveness, with or without loss of connective tissue elements, directly results from thermal or physical damage to the skin (Bhatia et al., 2022). Wounds, whether minor cuts or significant cuts, are essential to care for properly because if there is damage to the skin, it is feared that it will disrupt its function as the body's defence organ from the external environment (Chalabi et al., 2020; Salman & Mohammed, 2020). One form of wound is a dermapen scar. Dermapen is an electric pen that contains many microneedles for single use. The Dermapen uses an electrically powered pen to apply a vibrating stamp-like motion to the skin, creating a series of microchannels within it (Amer et al., 2018). After the microneedling procedure, the skin will feel hot red like a sunburn, and there may be signs of bleeding. For this reason, aftercare is needed to speed up healing and get better results. This is done by using a wound

dressing or wound bandage. Wet dressings can speed up the wound healing process compared to dry dressings.

Masks retain moisture or ingredients in the skin and create ingredients that help moisturize, hydrate, dry, or exfoliate the skin, depending on the ingredients used and the purpose. Therefore, facial masks allow the ingredients to penetrate better into the skin in a short time. Whether it's salicylic acid for acne, vitamin C for fine lines or retinoids to brighten dark spots, facial masks can offer a more concentrated dose and more intense version of the ingredients compared to other forms of application (Nilforoushzadeh et al., 2018; P et al., 2019; Paichitrojjana, 2021). Other forms of masks are also available in gel and fibre records, such as peel-off and sheet masks. The mask as a wound dressing is added with green tea extract to take advantage of its benefits in healing wounds. Both masks were applied to dermapen scars, and the healing was observed.

The research was carried out by collecting data related to observing treatment procedures. The data that has been collected is then processed to test the normality of the data. First, the researcher carried out a normality test. From the results of the data normality test, a significance value of 0.200 or greater than 0.05 was obtained, so it could be concluded that the data was normally distributed, which means the data was representative and able to represent the population. Normally distributed data is then tested for homogeneity using the Levene test to see whether the data is homogeneous or not. The result is a significance value of 0.063. If the significance probability value is more significant than 0.05, it can be concluded that the two treatment groups come from populations with the same variance. Finally, an Independent Sample T-test was conducted to see the significance value. It can be seen that the value (sig.2-tailed) using the Independent Sample T-Test is 0.101. The significance value obtained is more significant than 0.05, so H0 is accepted, or there is no significant difference in dermapen wound healing between the peel-off and sheet-mask groups. The main finding observed in this study was the healing of wounds of white rats (Rattus norvegicus) of the Wistar strain that were given a peel-off mask and sheet mask. Based on the average value of the rat wound length, it can be seen that there is progress in the healing of dermapen wounds during 14 days of observation. The peel-off mask group experienced 100% healing on the 13th day, while the sheet-mask group experienced 100% healing on the 12th. Based on this percentage difference, the researchers concluded that the group with the fastest wound healing was in the treatment group with a sheet mask containing green tea extract, namely 12 days. Healing dermapen wounds using a sheet mask containing green tea is more effective than a peel-off mask containing green tea extract.

Conclusion

Based on observations and data analysis that has been carried out, it can be concluded that treating dermapen scars using a peel-off mask and sheet mask containing green tea is effective in accelerating the healing of dermapen scars in white rats (Rattus norvegicus) of the Wistar strain. This is evident from calculating the percentage of wound healing, which reached 100% in both groups. Of the two groups, the group with the sheet mask experienced faster recovery, namely 12 days, compared to the peel-off group, which had a healing time of 13 days. The results of the Independent Sample T-Test show a significance value of 0.101. The significance value obtained is more significant than 0.05, so H0 is accepted, or there is no significant difference in dermapen wound healing between the peel-off and sheet-mask groups. Based on this data, it can be concluded that the peel-off mask and sheet mask could help heal dermapen scars, but there was no significant difference between the two groups. It is hoped that the results of this research will provide additional information regarding the effectiveness of using green tea (Camellia sinensis) extract cream in accelerating the healing of dermapen scars and regenerating the skin.

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