

THE EFFECT OF ULTRASOUND WAVE TO IMPROVE SKIN TURGOR

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ABSTRACT

The decrease of facial skin turgor causes the decrease of skin elasticity. The quality of skin depends on many factors; namely internal and external factors. According to the theories, the process of skin aging is associated with the decreasing production of metalloproteinases (MTP) by the cells and the decrease of proteins metabolism, known as Heat Shock Proteins (HSP) in the skin. It can cause elasticity of the skin, which is called turgor. If elasticity of skin decreases, it can trigger unclear leveling between epidermis and dermis, epidermis layer will push the dermis layer; hence, nutrition supply to epidermis layer will decrease and many problems will happen such as the appearance of wrinkle. This research examined the benefits of ultra sound wave (US) with 3 MHz of frequency to improve skin turgor in the facial area, in which it was expected that with ultrasound waves, it can activate HSP and MTP. US was applied continuously, with intensity of 1-1.5 w/cm², and in 10 minutes duration, the frequency of use was twice a week. This research was experiment, with quasi-experimental approach and design of pre and post test with control group design. This research was conducted at Mini Clinic for Skin Care at clinic Bunda Sella, Karangasem, Surakarta. The samples were taken by purposive sampling. There were 24 respondents who were screened based on inclusion criterias. The respondents were divided into two groups. Statistic test by using Wilcoxon test was applied on each group and in order to analyze the differences between two groups, the research used Mann Whitney Mann Whitney test. There was an effect of ultra sound to reduce skin turgor. The mean value of turgor for experiment group was 4.41 and control group was 0.5. The statistic result for treatment group: p-value was 0.0011 and p-value was 0.039 for the control group; and there were different results of statistic test between two groups and the p value was 0.0021. The conclusion of this research showed that ultrasound wave can provide a positive influence on the facial skin rejuvenation especially to improve skin turgor.

Keywords: Ultra sound wave, metalloproteinases, heat shock proteinase, skin turgor

BIOGRAPHY



Dwi Rosella Komala Sari. Lecterur in Physiotherapy Program, Faculty of Health Science, Universitas Muhammadiyah Surakarta. I completed Master's degree at Udayana University in 2010; then, I took informal education about Aesthetic and Cosmetics at Pacific International Beauty Institute, Surabaya and I graduated in 2011 and got *Diploma Cidesco*. My competency in lecturing is in Integumen field and improving skin care, and education based on physiotherapy intervention and skill.

INTRODUCTION

Beauty is something that is coveted by every woman. Since an early age, women were taught to regard her physical appearance as one of the important factors in growing pride and self-confidence. Furthermore, a woman will get bigger compliment for her feminine character. That is the basis of the importance of keeping up appearances for people to look at. Skin is the most important part of the body that must be maintained carefully, and facial skin is the most important part of the skin. If there is damage of facial skin, it will be difficult to recover and can reduce a person's appearance. One result of damage of skin is the decrease of skin turgor. The decline of turgor is a result of the body's metabolism mechanism which is not capable of working well and can also attack the skin. The decrease facial skin turgor is a condition that is indicated by bad skin elasticity due to inadequacy of water levels that causes fine lines and can trigger many wrinkles on skin [6]. Phonophoresis by ultra sound is an easier way to penetrate into the stratum corneum due to phonophoresis process. Facial skin women aging between 30 to 40 years old have histopathologic changes that is accompanied by their depletion leveling link dermoepidermal papillary dermis and epidermal's rete pags causing a decrease in communication and the transfer of nutrients to the skin. The decrease of collagen level also occurs around this age, which is caused by the release of pepsin digestin enzyme.

Physiologically, the cellular and molecular level of cells is to form metalloproteinase I-IV (MTP). The exposure of intrinsic or extrinsic cell imbalance will result in the forming of MTP I-IV, which results in the over production of MTP III and IV. MTP III will reduce the production of glucosaminoglicans and in MTP IV will overlap between proteocollagenase and proteomyelin. In the pathophysiology, it will lead to wrinkles and loss of skin elasticity or turgor. The damage of blood vessels due to internal and external factors will also reduce the metabolism of heat shock protein that is needed for skin [3].

Ultra sound is sound waves that propagate by using longitudinal waves consisting of expansion and compression. Ultra sound can be used as a medium to penetrate serum or drugs that is known by phonophoresis technique. Ultrasound has many level of frequency and levels of benefit. General frequency that is used in 1 MHz to 3 MHz and the frequency of 1 MHz is usually applied in the body. In this frequency, scouring ultrasound can be dropped into the skin more than 2 cm to achieve soft tissue musculoskeletal; on the other hand, for beauty purposes, ultrasound with a frequency of 3 MHz is applied in the facial area of the skin (cheeks, chin, forehead) [4]. Ultra sound wave has many effects, namely mechanic, heat and biology. Mechanic effect happens because there is compression and expansion process of wave in the tissue and it effect the variation of compressions in the tissue. These variations are known as micromassage effect. The effect of micromassage can improve the elasticity of skin, it caused micromassage that triggers thermal effect and improves the circulation of capillary. Heat effect can increase the permeability of cell membrane as well. Hence, it can improve the metabolism of fibroblast and fibers, improving the production of collagen and elastin. The biological effect of ultra sound wave increases the metabolism that will support the reparation of tissues. The effects of ultrasound wave perhaps can support the improvement of MTP and HSP reparation. Meanwhile, the existence of cell reparation will also increase the collagen production and activity of fibroblast; hence, cell can produce MTP well. All of these processes are expected to give good performance for skin [1].

METHODS

Participants: patient who came in clinic Bunda Sella, Jl Rambutan No 4 RT 2 / 6 Bulak Indah Karangasem, Surakarta. The numbers of population in Bunda Sella clinic were 32

peoples. The samples were taken by purposive sampling; and the respondents initially followed the screening stage according to inclusion and exclusion criteria. The criteria consisted of being woman, between 40 to 50 years old, having bad skin performance such as wrinkle, bad elasticity, bad circulation, bad skin pores, did not do skin care with any product for particular purpose, did not use products in facial area, did not smoking, was not diabetic, did not have open wound, did not have sensitive skin, and would be able to finish the research well according to the schedule. There were 24 respondents selected according to criteria, and they were divided into two groups. One group just did common skin care (cleansing and extraction) and another group was given US. The research was conducted from September until November 2015.

Study Measurements: turgor scale will use Global Aesthetic Improvement Scale (GAIS scale). Scale 1 is for worse than before the treatment, scale 2 is for no change, scale 3 is for obvious improvement, scale 4 is for marked improvement, and scale 5 is for strong improvement.

Statistical Analysis: the effect of ultra sound wave to improve skin turgor was analyzed by using Wilcoxon test. The difference between experiment group and control group was analyzed by using Mann Whitney test. The Statistic Analysis was determined through Wilcoxon test and Mann Whitney test because the amount of respondents in each group were no more than 30 respondents; hence, the analysis test was conducted by using non parametric tests; they were Wilcoxon test and Mann Whitney test.

RESULT

The description of turgor skin after it was given ultrasound therapy will be presented in the table below. Generally, ultra sound gives good change for the quality of skin performance.

Table 1. Shows the percentage of respondents according to the turgor scale after treatment

Turgor scale	n (experiment group)	n (control group)
1	0	4
2	0	5
3	2	3
4	3	0
5	7	0
Total	12	12

Table 2. Analysis by Wilcoxon test

No	Group	Mean	p
1	Experiment	4.41±0.71	0.00012
2	control	0.5 ±0.01	0.039

Table 3. Analysis the difference of two groups

No	Category	p
1	the difference of two groups	0.021

DISCUSSION

Table 1 showed the percentage of participant correlated with turgor scale. The pre-experiment conducted to all participants were given zero for turgor scale. After treatment, the researcher gave the respective values for each respondent on the result of treatment. The experiment group showed a significant increase after the treatment. There was no scale with worse than before treatment or no change after treatment. Twelve respondents showed very good result. In the control group, all of respondents have bad scale. While, there was four persons who have worse scale than before the treatment. There was no increase of skin quality; however, there was a decrease on the quality of skin, especially skin turgor

Table 2 showed the effect of ultra sound to reduce of skin turgor. It showed the p value of each group was $p < 0.05$. It meant that each group had positive effect towards the decrease of skin turgor. In addition, the experiment group showed high improvement than the control group. The value was 4.41 for the experiment group and 0.5 for the control group. Meanwhile, there was differences between the experiment and control group, p value showed that $p = 0.021$.

The result of all statistics above showed that ultra sound indeed gives positive effect to improve the quality of skin especially for skin turgor. The Ultrasonic wave provides a variety of effects on the cellular and molecular level of the cell, where the presence of vibration effects due to longitudinal wave is capable of generating heat and energy in cells. The generated heat is capable of making dilatation of blood vessels that supply nutrients and oxygen to cells need to fulfill. Energy from ultra sound wave will be utilized by cells in cellular and will increase the vascularisation of capillary.

The increasing vascularization will improve circulation in the skin by increasing the production of proteins that support the formation of heat shock protein (HSP) and then will activate the endothelial cells that act as the production of metalloproteinase I-IV (MTP). Endothelial cells will produce MTP II as cell nutrients that improve cellular and molecular by converting nutrients that will be absorbed into the material protein (HSP) that needs extra cells and matrix, forming a network of collagen and fibroblasts that is known as glycosaminoglycan (GAG). Energy balance in cells is used to control the activity of MTP IV; hence, it will not produce excessive MTP III that is supported by proteokolagenase and proteomyelin from MTP IV [3].

MTP IV will improve skin turgor so that the skin becomes more elastic. The set of effects that occur will refit the cell and support the establishment of MTP and HSP. If the number of proteins increased at the cellular level, the cell nutrition need will be fulfilled and can form a perfect MTP. The fulfillment of the nutrients needed by the cell will increase collagen and elastin; therefore, there is no degradation of skin resulting in loss of ability to bind water in the stratum corneum. The Fulfillment of nutrients will also increase its ability in binding traffic stratum corneum water that will enhance collagen synthesis that will be transcribing mRNA for regenerating of cells. As the result, it will improve skin turgor or elasticity [5].

CONCLUSION

According to the analysis statistics, there was an effect of ultra sound to rejuvenate the skin turgor. US give good effect to improve the performance of facial skin which has undergone aging and can reduce the problems of skin that are caused by aging process.

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