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Study On A Mini-Fan Massage To Make Shaving Easier

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Abstract *— Learning to shave is one of the essential skills for adult men. For physiological reasons, most adult men grow beards, and men's trimming, and management of beards will earn them more respect. For adult men, a sharp razor and proper shaving skills are necessary. Skin irritation caused using blunt blades or failure to use appropriate techniques can cause razor burns. Therefore, comfort during shaving is as essential as the smoothness of the skin after shaving. For shaving, smooth the skin effortlessly and without any skin irritation for a perfect shaving experience. This paper proposes the mini-fan massage method to reduce the irritation of the razor to the skin and increase the comfort of shaving. It can soften the beard and become easier to be removed, and it can soften the skin or secrete oil to increase skin lubricity. This method can make shaving easier and more comfortable. This paper uses the Sound Frequency Spectrum Analysis to observe the changes in the friction sound components between the razor and the skin and beard before and after the mini-fan massage and further explain the changes in the friction force. The experimental results show that the mini-fan massage method can reduce the friction between the razor and the skin and beard.*

Keywords *— Mini-Fan Massage, Wet Shaving, Razor, Comfortable Shaving, Shaving Sound, Sound Spectrum Analysis.*

I. INTRODUCTION

Almost every adult male needs to trim his beard. Men's beard trimming is like women's make-up, allowing them to maintain a clean and tidy impression. For shaving, people want to have smooth skin after shaving, and they also want to be as comfortable as possible during shaving. Shaving burns are a common problem. It refers to skin irritation caused using blunt blades or failure to use appropriate techniques. It is manifested as a burning sensation on the skin, and redness and swelling may occur in severe cases. This situation is more likely to occur in people who use electric shavers. Because Wet shaving uses lubricants and keeps the face moisturized during the shaving process to relieve the symptoms of shaving burns. Therefore, people who often shave their beards and thick beards prefer wet shaves. The perfect shaving experience should shave effortlessly, make the skin smooth like a baby, and without any usual skin irritation. This is also the ultimate pursuit of many razor manufacturers. For example, they developed some electric shavers for people to shave more conveniently and quickly. They developed some lubricants to make the shave smoother, and the skincare lotion can alleviate the discomfort after shaving. They even produce razors with a heating function, its heating part can make the hair softer, more easily cut off, making shaving easier. However, these razors are expensive and not suitable for everyone. So Sori Sound Engineering Lab proposed a new method, making shaving easier, and the cost is also little. [1] [2] [3]

This paper is aimed at studying ways to make shaving easier. From the perspective of economy and practicality, people can get a better shaving experience in this way. The second chapter introduces the types of razors and their working principles. Chapter 3 explains in detail the sound and wind resonance massage method. In chapter 4, experiments are carried out, and the feasibility of the new method is verified through acoustic analysis of the shaving sound of the razor. In chapter 5, Conclusion.

II. TYPES AND WORKING PRINCIPLES OF RAZORS

At present, shavers are mainly divided into two categories, namely manual shavers (wet shave) and electric shavers (Beard trimmer). Wet shaving refers to the traditional shaving method. The razor is mainly single-blade or multi-blade, and the blade is at a certain angle with the skin so that the blade cuts the hair. Before wet shaving, the area to be shaved is usually immersed in hot water by showering or bathing with a wet towel for several minutes to soften the skin and hair. Foaming agents or lubricants, such as creams, shaving soaps, or oils, are usually used after that. Lubricating and moisturizing the skin to be shaved helps prevent irritation and damage. Moreover, apply skincare lotion after shaving to tighten skin pores and retain moisture. The electric shaver uses the principle of rotating machinery to cut the hair. It uses electricity as energy to drive a micro-motor to rotate the blade at high speed. The rotating blade and grid form a scissors effect to cut the hair. As shown in Figure 1, and Figure 2, the main difference between the working principle of wet shaving and beard trimmer is that wet shaving is to cut the hair with a single stroke of the blade, while Beard trimmer is to cut the hair between two blades. So, the cut surface of the wet shaved hair is smoother. On the contrary, the cross-sectional surface of the hair cut by an electric shaver is rougher. [4] [5]

Fig. 1. The working principle of single blade.

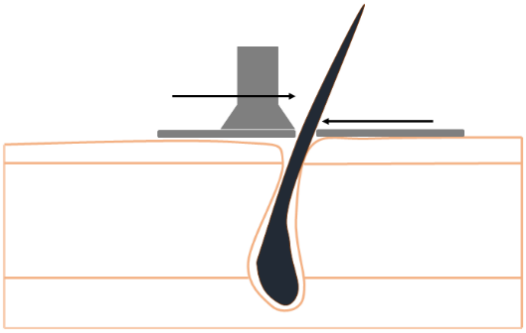

Fig. 2. The working principle of electric shaver

In order to enhance the shaving effect and skin smoothness, some wet shaves use multiple blades. As shown in Figure 3, when the blade touches the hair, the front blade cuts the hair and lifts it from the hair follicle, and the rear blade cuts the lifted part of the hair again. After all the blades pass through, the hair follicle pulls the hair back below the skin surface, making people feel smooth. In other words, a multi-blade razor lifts a part of the hair, then cuts it off, and the final hair will be hidden under the skin. In this way, though the beard is hidden under the skin to make the skin becomes smooth, the pulling force of the hair will be more likely to irritate the skin. Therefore, people often use hot water before shaving to relax the pores and soften the hair to reduce skin irritation.[6] [7]

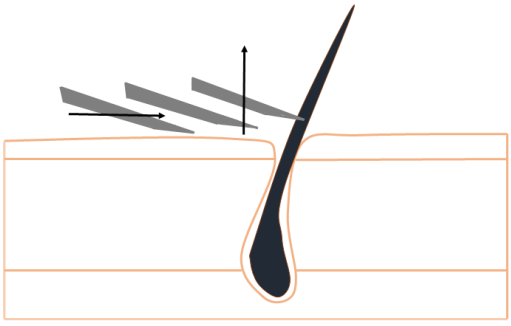

Fig. 3. The working principle of electric shaver with multiple blade.

III. THE MINI-FAN MASSAGE METHOD

This paper proposes the use of sound energy to massage the skin. Its purpose is the same as applying hot water to the face. That is to relax the pores and soften the hair to be easier and more comfortable to shave. Put the mini fan close to the facial area to be shaved before shaving the beard with a razor. Let the wind and the sound pass through all the beard parts. Keep the way for one minute. The other steps are the same as the wet shaving process.

The mini fan is a sound wave transmitter. The sound is composed of the sound of the motor, the friction sound between the fan blades and the air, and the friction sound between the air (wind sound). As shown in Figure 4, it is the waveform and the Spectrogram of the mini fan's sound. It can be seen from the figure that the fundamental frequency of the sound is 500hz, and multiple harmonics appear at multiples of the fundamental frequency (1kHz, 1.5kHz, Etc.). The spectrum energy is mainly concentrated below 8KHz. The spectral distribution is relatively flat, similar to white noise, and still has high energy in the high-frequency range. [8] [9].

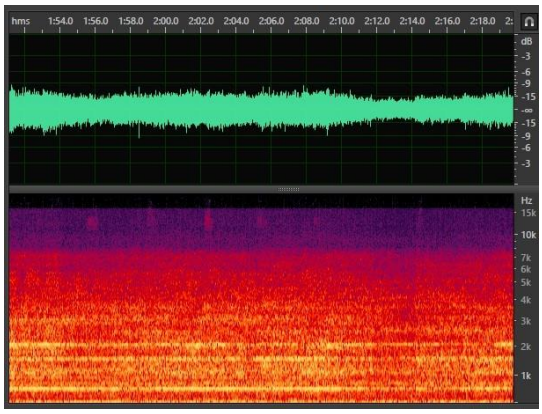

Fig. 4. Sound Waveform and Spectrogram of Mini Fan.

Sound is the propagation form of the mechanical vibration state (or energy) of an object. Its transmission requires media materials, such as air and water, to spread at different speeds in different media. The propagation speed of sound waves in water is four times that of air. According to the formula $V = {}^{\lambda}/_{f}$ the frequency remains the same, and the wavelength of sound in water is four times that of air. In other words, the sound penetration in water is stronger. Because 70% of the human body is composed of water, the sound wave energy can be absorbed by the human body and form a resonance effect in cells and tissues. Resonance can cause the movement of substances in the tissue cells. The massage effect of sound waves makes the plasma flow in the cells, causing the cells to oscillate, rotate, and rub. This effect of cell massage, also known as "internal massage," can change the permeability of cell membranes, stimulate the diffusion process of cell semipermeable membranes, and promote metabolism. Changes in the internal structure of cells, leading to changes in cell functions and making the hard connective tissue stretch and soft. During the propagation of high-power sound waves in human tissues, their energy

is continuously absorbed by the tissues and turned into heat, causing the body's temperature to rise. This warming effect can increase blood circulation, accelerate metabolism, improve local tissue nutrition, and enhance enzyme activity. It means that the mechanical energy of sound waves is converted into the kinetic energy of cellular. The motion between the materials is subjected to resistance and generates heat energy. These energy conversion processes are equivalent to a massage for cellular material. It is the composition of the cell relaxation material that has become more relaxed. Therefore, the sound wave of the mini fan can massage the cells, relax the capillaries, relax the pores, and make the hair soft. Shaving the beard has also become easier. [10] [11]

IV. EXPERIMENTS AND RESULTS

The subject was an adult male who had been growing his beard for a week. The experimental device was a tape recorder, three-blade wet shaving, shaving soap, and a mini fan. The experiment site was in a quiet bathroom. In the wet shaving process, use a mini fan sonic massage instead of hot water to apply the face. Other operations are the same. The experiment is divided into two parts. The first is the normal wet shaving process. Only one-half of the face is shaved, and the shaving sound is recorded for one minute. Then, before shaving, the mini-fan sonic massage is used for one minute, and the other half of the face is shaved, and the sound is recorded. Then perform frequency analysis on the recorded sound. Frequency analysis uses 1024-point FFT and uses hamming window filtering. [12] [13]

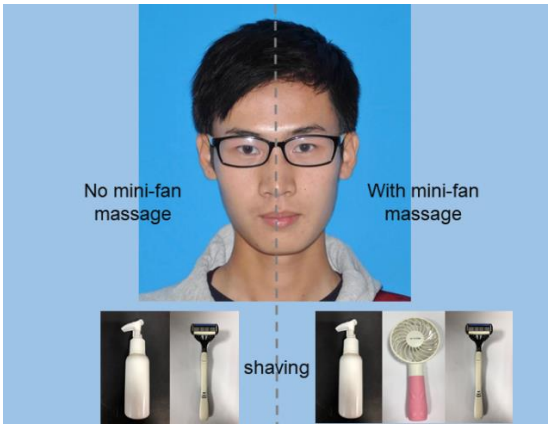

Fig. 5. Experimental Process

Figure 6 is the sound analysis spectrum diagram of the general wet shaving process and the wet shaving process after sonic massage. The X-axis represents frequency (0hz~2KHz), the y-axis represents sound intensity (dB). Yellow is the sound spectrum curve of the general wet shaving process, and blue is the sound spectrum curve of the wet shaving process after sonic massage. As can be seen from the figure, there are three resonance peaks in the spectrum. The first formant is the razor's natural frequency. The second formant is the sound spectrum component generated by the friction between the razor blade and the skin. The third formant is the spectral component of the sound produced by the friction between the razor blade and the beard. It is easy to find that the first formant is the same, but at the second resonance, the blue spectrum curve is lower than that of yellow, and the spectrum range is 2KHz~8KHz. This shows that the friction sound of the razor blade and the skin is reduced. That is to say. The skin cell tissue is softened by the mini-fan massage of the skin cells, which reduces the frictional resistance between the cells and the blade. Similarly, at the third formant (10KHz~18KHz) position, the amplitude of the blue line is lower, and the basket line is about 4dB lower than the yellow line. This means that the friction between the razor blade and the beard is reduced. The massage effect of sonic resonance also relaxes the protein structure that composes the hair, the texture of the hair becomes soft, and the blade is easier to cut the hair. As a result, the friction between the blade and the cutting surface of the beard is small, and the frequency spectrum component of friction is reduced. All in all, through the analysis of the spectral components of shaving sound, it is found that the mini-fan massage can effectively reduce the friction between the razor blade and the skin and beard. Make shaving more convenient and comfortable.

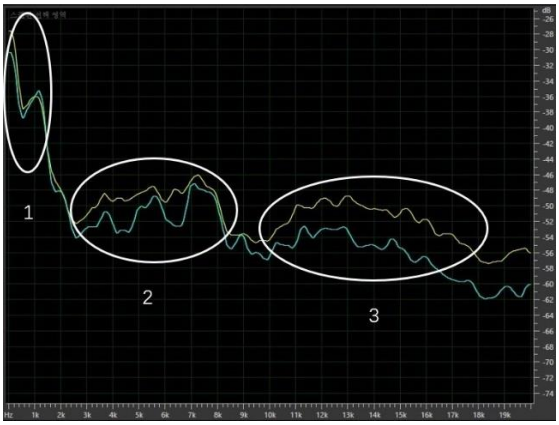

Fig. 6. The sound spectrum of general wet shave (yellow line) and the sound spectrum of wet shaved after the mini-fan massage (blue line).

V. CONCLUSION

This paper proposes a method to massage the skin and beard using mini-fan before shaving to get a more comfortable feeling when shaving. Then record the sound of shaving before and after using this method and perform spectrum analysis. By analysing the sound of blade contact with skin and beard, the friction between them can be judged.

Experimental results show that after using the sonic resonance massage method, the amplitudes of the second and third formant of the sound spectrum are reduced, and the third formant is reduced more obviously. The decrease of the second formant amplitude indicates that the friction between the blade and the skin is reduced. Similarly, the decrease of the third formant amplitude means the friction between the blade and the beard. On the one hand, the reduced friction between the blade and the skin can reduce skin irritation. On the other hand, the reduced friction between the blade and the beard means that shaving will

become easier. This method improves people's comfort when shaving their beards.

This paper uses a mini electric fan as the emission source of a sound, and the sound is white noise. In future, add single-frequency sound waves to study the massage effects of different frequency sound waves on the skin to increase shaving comfort.

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