

Treating Damaged Skin

By Dr. Des Fernandes

Iontophoresis

There has been a resurgence of interest in iontophoresis in the medical profession. Why call it a renaissance of iontophoresis in this day and age? We've known about galvanic current for about 200 hundred years and iontophoresis (a word derived from Greek meaning the transport of electrically charged chemicals called ions) through skin was demonstrated almost 100 years ago.

Skin care therapists have used galvanic currents to treat skin for about 70 years -so what can be new? First activate the skin on negative current, then massage and finally soothe the skin on positive for a refreshed appearance. Right? No! Wrong!

Of course these ideas are wrong because they ignore the basic scientific principles. First of all one has to understand that iontophoresis will only occur if the targeted active chemicals have an electrical charge (i.e. they are ions carrying either a positive or negative electrical charge, or will ionise with electricity). When a low intensity galvanic current is applied to a molecule that can dissociate into a positive ion (cation) and a negative ion (anion), then it dissociates more readily in the presence of water and salts. Negative ions move towards the positive pole, and positive ions move towards the negative pole. As a result ions can be carried to deeper layers of the skin and concentrated there.

If a positive current is applied to the skin together with appropriate gels, then the positive pole will act exactly like a magnet (North Pole repels North Pole and alternately South Pole and vice versa) and repel cations and attract anions. Therefore, if one wants to facilitate the penetration of a cation then one has to apply a positive charge to the skin. However, if one wants to make an anion penetrate deeper into the skin, then one has to apply a negative charge.

To understand iontophoresis better, then one must go back to the very first demonstration of its power. Two rabbits were selected and one poison that has a positive charge was applied to one ear and a poison with a negative charge was applied to the other ear. Only one ear was treated with an electrical current. When the positively ionised poison was treated with a negative current, nothing happened. When positive current was used then the rabbit died! So either positive current was responsible, or the positive poison ions moved through the skin into the blood and killed the rabbit. The second rabbit then proved that it was the ions because when a positive current was used, nothing happened, whereas when a negative current was used, the rabbit died! The only explanation was that the positive and negative ions had been repelled by their similar charges and had gone through the skin.

This was a magnificent demonstration but unfortunately not enough people paid attention to it and it was lumped together with things like hypnosis and ignored by the medical profession. In recent years, research workers have looked again at iontophoresis and have tried to define its mysteries. As a result we've learned a great deal about iontophoresis and today research workers believe that iontophoresis can very often be as effective as injections into the skin or muscles. Diabetics may one day wear only a simple instrument like a watch and in that way dose themselves with enough insulin to keep them selves healthy. Other powerful medicines can even be taken more than 2 cms. Into the body by simple electrical currents. Iontophoresis promises to become a major method for treating people without the

use of injections and other invasive techniques. The research workers have realised that we have to know certain properties about ions, not merely that they can ionise. When a molecule that can be ionised at an appropriate pH is subjected to a galvanic current, the molecule ionises into its anion and cation. We have learned that the concentration of the ions is important. The strongest solution is not always the best. We also know now that the properties of the current are important. Certain wave shapes and intermittent application of the current are better than continuous galvanic current.

There are some very important rules that have to be followed when doing iontophoresis.

1. The selected molecule must be ionised into positive and negative components and be maintained as ions during the treatment. You cannot iontophorese chemicals that are not ionised.
2. The size of the ion is important. For example even though a complex protein like collagen may be possible to ionise, the size of the important ion of collagen is so large that it cannot be transported through skin.
3. There is a limit to the number of polar substances that can be used simultaneously. We believe that during iontophoresis "pores" open up through membranes and the charged particles can move through them. If there are too many charged particles then the "pores" may be "blocked" by the crowd of ions converging all at once.
4. The ion must be water-soluble because electricity is only conducted through water and not lipids.
5. The pH of the active gel is of fundamental importance. The right ingredient at the right concentration won't work properly if the pH is wrong. Each ion has its own ideal pH at which it will be ionised best.
6. The current used must be appropriate. You cannot use any current you like.
7. The current used should be high enough to be effective and still safe. The higher the current, the faster the ions will move.
8. Intermittent current works better than continuous current because as the ion moves into the skin it will react with other chemicals and needs to be re-ionised. I have used the Environ® Ionzyme DF 1998 machine for the work that I have done.
9. The treatment period should be at least 10 minutes and probably not longer than 30 minutes. Most of the ions pass through the skin at about 8 to 15 minutes and then relatively little passes through after 30 minutes. I prefer to use a "field" of electrical charge rather than use rollers which produce rather localised effects. I use a specialised gauze that retains moisture (Hazegauze®) more effectively than any other gauze I have used.
10. It is possible, maybe even highly desirable to treat skin with only one polarity. It is not necessary to treat the skin with the opposite current after doing the active

treatment. If you do that then you will reverse the beneficial effects of the active treatment!

11. Of course, the ion will only have positive effects if in fact scientific research has proved that it is effective. Ionising salt water into skin cannot have the same effects as ionising a proven rejuvenating vitamin ion into the skin.

We are also learning about electro-osmosis which is closely allied to iontophoresis. In this case, ions move along the electrical "concentration" gradient i.e. from a high current to a low current. Another intriguing phenomenon is electro-poration. By this we mean the "holes" created in membranes by electrical current which then allow non ionised molecules to pass through the membranes.

iontophoresis when correctly used is proving to be a powerful tool. However, it does have problems. First of all it can only be used on molecules that can be ionised. Not all molecules can be ionised at physiological levels and some cannot be ionised. Secondly, if strong currents are used and the current is built up too quickly when using simple galvanic current, then a burn may occur. One has to remember that in fact some very complex chemical changes occur at the exact site of the iontophoresis contact points. Strong alkalis may be formed or strong acids may damage the skin.

Modern iontophoresis has been used to minimise wrinkles, to eliminate pigment blemishes, soften scars and normalise skin. However, this only happens when the gels used contain the right ingredients, at the right pH, with the right concentration, treated with the correct current properties for the correct amount of time. Change only one of these important points and the treatment becomes a simple complex manipulation of skin and the client's purse.

With properly controlled iontophoresis up to 400% better penetration can be achieved under ideal conditions and the improvement of skin can be hastened quite dramatically.



Schmidt published the results of iontophoresing retinoic acid or Estriol into skin scarred by acne. This gave results that are comparable with dermabrasion of the skin. Dermabrasion thins the skin and results in an artificial looking surface whereas iontophoresis of the skin nutrients actually makes the skin thicker, healthier and more beautiful. I have used both vitamin C and A to achieve this result in about 30 treatments done twice a week initially and then later once a week for 20 minutes on each occasion.



This man wanted his facial skin to be the same colour as his neck skin. Unfortunately he came from West Africa and we could only do 11 treatments. However, one can see that the facial skin is now very similar to the neck skin. We used a gel of magnesium ascorbyl phosphate and retinol. **Sonophoresis**

Sonophoresis has the advantage that the compounds do not have to be ionised. The best explanation for the movement through skin seems to be explained as cavitation of the skin cells and membranes. This process of cavitation occurs during the treatment but these cavities disappear after the treatment and histological examination of the skin has shown that the skin is normal after the treatment. These may in fact be the same pores as are induced by iontophoresis. Mitragotri has shown that contrary to expectation, cavitation of the skin occurs better the nearer one is to audible sound. In fact in the range of the sounds that dolphins emit their sonic messages, we get the best cavitation and penetration of molecules through skin. This range is at most only 10% of the sound that is used in conventional ultra-sound machines. Mitragotri has described that with sonophoresis he could get about 4000% better penetration after five minutes of sonophoresis at 20 KHz than with topical application.



I believe that the higher levels of vitamin A within the cells results in higher levels of retinoic acid which then stimulate mRNA responses which lead to faster growth of keratinocytes and greater production of collagen. When vitamin C is included in the cocktail then wrinkles can actually be safely "melted" away. Please see the photo gallery for results from using iontophoresis and sonophoresis using the Environ® Ionzyme DF 1998 machine

