

Intranasal Light Therapy bridges Traditional Chinese Medicine with Modern Medicine

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Summary

The origin of Traditional Chinese Medicine (“TCM”) largely goes back to the classical text, “Huangdi Neijing”. It is a compendium of work up to the point when it was compiled more than 2000 years ago, and when translated with integrity to its original meaning and context holds up remarkably well today.

The ideal of TCM with regards to Qi and Blood is to ensure that oxygen and other nutrients are circulated throughout the vascular network in the body unimpeded. It need not be viewed as a metaphysical phenomenon as many have learned to believe. The main key lies in the health of the blood circulatory system.

TCM’s holistic approach is persuasive in offering itself as complementary to modern medicine. Its focus on the blood circulatory system should be appealing – take care of that and you take care of most of your health issues. Pharmacological intervention with all its side effects should rationally be secondary to a natural and inherently safe pathway such as this.

However, modern skeptics view the TCM modalities of acupuncture, qigong and herbal therapy remain largely short with regards to credible evidence to support their efficacy. Notwithstanding that argument that TCM should be understood under a different set of paradigms, it opens the door to a new non-pharmacological approach that is true to the traditional holistic approach and yet has credible scientific bases and evidence.

In this respect, this paper proposes a light therapy modality, which as a group is already deployed as mainstream medicine in many countries but largely unfamiliar to the wider North American medical community. Specifically, the method of low level light therapy (“LLLT”) has built up a substantial body of evidence to support the indication that it is able to achieve red blood cell (“RBC”) disaggregation, lower viscosity and hence better blood circulation. The improved blood circulation is achieved from the method of illuminating the blood (often called “blood irradiation”). Until now, the more common approach to “blood irradiation” (mainly in Europe) is to perform intravenous irradiation. The MedicLights Intranasal Light Therapy method and system is a new non-invasive way to achieve the improvement in blood properties, and hence improve blood circulation, consistent with the original TCM objective.

This results in the body restoring homeostasis, which in the language of TCM, balances “yin and yang” forces throughout the body. The result is manifested successful direct intervention for many diseases and disorders, which is supported by credible scientific evidence.

Introduction

Throughout history, civilisations appreciate that blood is fundamental to the survival and propagation of human life. However, blood circulation has not been substantially understood until relatively recently. To the Chinese, the theories related to “Qi” have been the backbone of their medical therapy. And it has always been closely linked to blood and its circulation.

According to age-old Traditional Chinese Medicine (“TCM”) principles, the relationship between Qi and Blood is often quoted as follows: “Qi is the “commander” of Blood, and Blood is the “mother” of Qi. Where Qi goes Blood must follow. Where Qi is, Blood is already there”. One cannot exist without the other and both support life. Substantial revisions and updates have been made to the original thesis written more than 2,000 years ago. An exposition of this TCM understanding of Qi and Blood is provided in the **Appendix 1** to this article.

This paper discusses existing and new evidence to bring up to date the centuries-old understanding,

Qi and Blood Circulation: Reconciling TCM and conventional medicine

To many members of the modern medical community, the concept of *Qi* as commonly understood, is irreconcilable with modern science. Indeed an in-depth study of this “Qi” from the Chinese historical texts of various sources have shown that it is an amorphous term. It could mean any of the terms: *vital energy, breath, air, gas, spirit* or some kind of mysterious *force* that is as ancient and potent as the what makes the universe exist.

Qi has been a key factor in early Chinese philosophy, religion, geomancy, martial arts, meditation methods, acupuncture, herbal therapy, shamanism and almost anything that governs the lives of ancient Chinese. It is beyond the scope of this discussion to venture beyond the medically relevant definitions. For this reason, we will confine discussions to what was understood by ancient Chinese physicians. This inevitably takes us back to the classical texts that have become the foundation of TCM. Then an attempt to understand Qi within this scope becomes more manageable; and we learn that the problem of reconciling TCM and conventional medicine may not be with the original texts but with accuracy of their translation.

The foundation of Chinese medicine is often credited to a book called the *Huangdi Neijing* or “Yellow Emperor’s Classic of Internal Medicine” which is believed to have been written over 2,000 years ago. It is a massive manual, a compendium of observations over many generations, perhaps even longer than the history of modern medicine.¹

The manual demonstrates how advanced Chinese medicine was at the time. The Chinese were already performing detailed dissections and able to describe the functions of the major organs including the heart as the organ that pumps blood throughout the body. Western medicine didn’t discover this until another 1500 years later in the 16th century. The Chinese at the time even knew which vessels were pumping blood away from the heart, which ones back to the heart, and which ones specifically to which organs. In other words they already understood the key elements of blood circulation.

From the time of the Greek civilisation until the 1600s, Western medicine had thought that the heart was a generator of heat and the role of the artery was to “cool” the blood, aided by the lungs which “fanned” it.² In an understanding that were behind the Chinese’ centuries earlier, pre-seventeenth century western medicine thought that the arteries would dilate by sucking in air and then contracting to discharge vapours through pores in the flesh and skin. It was only when William Harvey published his landmark work in 1628 that blood circulation was presented in the way that we understand it today.³

Today the understanding of the function of blood circulation has played a central role in cardiovascular physiology.⁴ There is a large body of peer-reviewed publications relating to blood rheology (flow of blood) being the basis of many important health problems. Although these published findings have not been refuted or caused controversy, they are unfortunately simply ignored.⁵

On the other hand, TCM in whatever version recognizes the central role that blood circulation plays by way of blood working together with “Qi” for general well-being and overcoming diseases and disorders. Many TCM practitioners believe that Qi and Blood must co-exist and work symbiotically for the human being or organism to exist. The problem with the concept of Qi as commonly understood today is that it defies any conventional scientific basis in its identification as a “vital energy” or other similar descriptions. To the skeptic this esoteric phenomenon has no place in evidence-based science.⁶ There are numerous articles in the same vein but in the end, Qi is not measurable and remains a concept.⁷

Qi is popularly recognised as an entity outside the blood circulation system, and is *energy* in a conceptual way. However, the classical Chinese language is very context-sensitive and the relevant surrounding factors should be considered to extract the true meaning of the word. With this taken into account, it turns out that the most accurate translation of Qi is not “energy” but “air” (or sometimes referred to as “breath”). We may consider that “air” could have been embellished as “vital energy”.

When the classic *Huangdi Neijing* was first documented it was an accumulation of works that were built up during the ages that shamanism prevailed and illnesses were attributable to demonic forces.⁸ The idea that *Huangdi Neijing* distanced itself from superstition and introduced the effects of diet, lifestyle, emotions, environment, and age to address diseases was revolutionary and far beyond the times. But it was still a different time, and the understanding of science and medicine as we know it today was not there to provide credible scientific bases for cross-referencing as many scientists could relate with.

The *Huangdi Neijing* and related scripts were written in a Chinese dialect that hadn’t been in common use for more than a thousand years before it was translated first into a European language. It is also not a language that most modern Chinese people can understand. Sivin, an historian of science gave the opinion that “no available translation (of it) is reliable.”⁹

Researchers like Kendall re-examined the original texts and assign more precise translations. This discussion has drawn upon Kendall’s work to understand what the original text actually mean in today’s scientific terms.¹⁰ For example, in the *Huangdi Neijing*, the authors described

the lungs breathing in what they call “Da Qi”, which is literally “great air”. This is different from the interpretation of “Qi” as *energy*, first translated into French by Georges Soulie de Morant, a French diplomat based in Shanghai in the 1930s, whose work became the basis of later understanding of TCM. *Air* would have been scientifically easier to appreciate than *energy*. The texts explained that when the lungs breathed in air, they extracted the *Qi* from the *Da Qi* – that is, the lungs extracted a vital *air* substance from “great air”.

What this *air* substance extracted by the lungs is, can only be interpreted today as *oxygen*. In the Chinese dictionary, there are ten definitions of Qi but none refer to it as “energy”. Now we can start relating Qi more clearly to *blood*, specifically red blood cells (“RBC”) which are the main formed elements of blood. Their main function is to carry oxygen and perfuse it throughout the body, or as the Chinese say, “nourish the body”. The Chinese at the time would not have known about oxygen as a molecule but they did understand that we extracted something essential to life from the air we breathed – which they sometimes called “vital air”. TCM teaches that Qi resides in blood. *Oxygen* is the “nourishing” molecule that resides in blood.

In *Huangdi Neijing*, the authors used “Mai” to describe the *vessels*. “Xue Mai” would be literally translated as blood vessel (“Xue” being *blood*). It was Soulie de Morant (who had identified Qi with energy) who took the word Mai and translated it as the French word “Meridian”.¹¹ This was despite the fact that there was no word for Meridian in the ancient Chinese language. But this has been stuck with us ever since. Based on the persuasiveness of de Morant’s writings, his interpretation of this new alternative science secured a firm hold on European imagination which then deeply influenced subsequent conventional knowledge of TCM.

Soulie de Morant promoted the idea that blood, along with a mysterious and undefined energy (Qi), circulates through invisible “Meridians” in the body. This had no relationship to what was written in the classic texts. The ancient texts had diagrams of acupuncture points on the body. De Morant took pictures of these diagrams, drew lines to connect them and created the concept of the Meridian system. The original texts already had drawings of major arteries going from the trunk into the legs. The points were arranged along these arterial routes. Therefore the “Meridian” as offered by de Morant was a misnomer for arterial networks.¹²

Based on de Morant’s work, the understanding of Qi would appear to be metaphysical, functioning in parallel while co-existing with the blood system. However with the literal translation of Qi as *air* (which can be interpreted as *oxygen*) and Mai as *vessel*, it becomes clear that there is no disagreement between ancient Chinese medical theory and contemporary principles of physiology for blood circulation. Therefore TCM is not metaphysical but as real as what we understand modern medicine to be. It does establish that the ancient Chinese understood correctly that blood circulation would be the key to health. The primary aim would be to keep that “Meridian” channels unblocked, which would mean to keep the blood circulating unhindered so that the whole body is thoroughly nourished, whether as preventive medicine or as an intervention to overcome diseases.

Early TCM thought leaders like Willem ten Rhijne, back in 1683 (and before de Morant’s interpretation involving energy flowing through meridians took a foothold) had already

understood that the Chinese focus was on blood circulation along with the structure and function of the vessels.¹³ Today, prominent Chinese TCM researchers such as Xiu Rui-Juan promotes the central role of blood circulation in health, and more pointedly that impaired blood flow to any region of the body, including internal organs, can result in pain and dysfunction.¹⁴

With the passing of several years of further scientific progress and before he died in 1955, de Morant corrected his definition of Meridians to say that they were actually *blood vessels* (but he did not correct his definition of *Qi* being *energy*). However, one may argue that energy is latent inside the oxygen molecule that the red blood cells (“RBC”) are carrying; and with one degree of separation, the understanding of de Morant, and his many Western TCM followers are perhaps not really different from modern scientific knowledge.

Even the concept of *balance* (in *yin* and *yang*) is not out of place in modern biology. It is equivalent to *homeostasis* – the condition in which the body or cell maintain equilibrium/stability/balance within its internal environment when dealing with external changes. This is an essential condition for the well-being of a mammalian organism.

The concept of blood stasis

We have established that having good blood circulation is a fundamental principle of TCM. This also means that the state of compromised blood flow, or any form of stagnation should be avoided. In this context, “blood stasis” is a term that is often used in TCM to describe this unfavourable condition. In modern Chinese medicine this is related to many symptoms of old-age, when everything slows down and one becomes senile and vulnerable to diseases, and then eventually the end of life.¹⁵ This knowledge is an advancement from the past TCM theory which postulated that geriatric symptoms relate to the more abstract understanding of “vacuity” or emptiness in the key organs.¹⁶

Under the microscope, blood stasis will be manifested as RBC aggregation, which can be observed as RBC being “stuck together”, impeding blood flow. This is evident from a blood sample in Figure 1 below. Experts in TCM can relate blood stasis to poor blood rheology - which can be identified with RBC aggregation as a risk factor.¹⁷

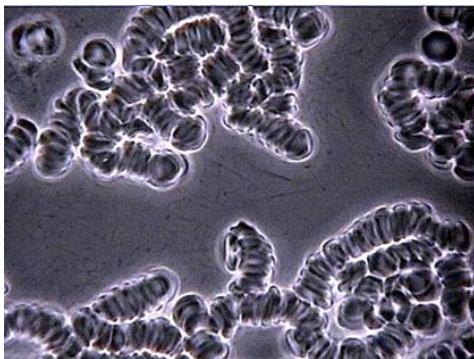


Figure 1: Red blood cell aggregation.

From stasis to red blood cell aggregation

Recent research also shows that stasis in the vein is associated with RBC aggregation.¹⁸ The aggregation is found to be due to the presence of macromolecular proteins such as fibrinogen and globulin.¹⁹ Fibrinogen is the protein which is sensitive to inflammation and helps with the blood clotting function. It is a dominant factor in RBC aggregation.²⁰ Since inflammation is caused by an illness or disorder, one can attribute the presence of blood aggregation to the presence of an illness or a disorder. Therefore when RBC aggregation occurs, it means that the subject is at least not in perfect health.

Red blood cell aggregation to shear stress

Blood has a non-Newtonian fluid behaviour. Once it gets moving and builds momentum, it flows fast. Unlike water, which exhibits much more Newtonian properties, blood moves sluggishly at low speeds and is more liquid at fast speeds. When the heart is resting between beats (diastole) it becomes more viscous and then when the heart forces blood out (systole), with the higher shear stress blood becomes less viscous.

The presence of high RBC aggregation (along with hematocrit and plasma viscosity) is a factor contributing to low shear stress. Low shear stress leads to high whole blood viscosity.²¹ Eventually, elevated blood viscosity and RBC aggregation are important factors in adversely affecting blood circulation, cardiovascular diseases and a number of diseases, as found in the cumulative work of renowned haemarheology (blood flow) researcher, Dintenas.²²

Low shear stress regions along the arterial walls is associated with the occurrence of lesions.²³ This leads to deposit of plaque in these areas. When the plaque builds up, blood flow is further impeded, leading to turbulence and more plaque deposition. When the plaque deposition reaches a critical stage, it often causes vascular occlusive (blockage) disorder²⁴, and thrombosis (blood clot) both in arterial and venous systems. This becomes the prelude to cardiovascular events such as heart attacks and strokes. Before that happens, the subject exhibits classic symptoms indicated in TCM with blood stasis – such as reduced immunity, increased tiredness and so on, making the subject vulnerable to diseases.

Effect of RBC aggregation on blood circulation and tissue perfusion

There is considerable amount of research conducted by a core group of researchers on the effect of RBC aggregation on blood circulation and tissue perfusion. Among the leading researchers are Baskurt and Meiselman. It is apparent that this body of research is growing with evidence that the interplay of these elements hold important keys that are central to a person's well being.²⁵ A more detailed extract of their review are presented in **Appendix 2**.

In summary there is substantial evidence to show that RBC aggregation impedes blood flow. The presence of RBC aggregation affects microcirculatory blood flow, venous flow, whole organ perfusion, and tissue hematocrit. Freedom from RBC would be a very desirable health condition.

Red blood cell aggregation is an independent risk factor

Studies also show that the presence of RBC aggregation is an independent risk factor for vascular occlusive disorder²⁶ and thrombosis both in arterial and venous systems²⁷. With these properties, RBC aggregation would also be identifiable with poor circulation in the small capillaries. These studies show that RBC aggregation is also related to blockages in the larger vascular network, caused by the formation of plaques.

TCM modalities to overcome stasis and improve blood circulation

To overcome stasis and improve blood circulation, TCM modalities usually include one or a combination of acupuncture, qigong exercise and herbal therapy. There are studies that support as well as dispute the efficacy of these therapies, the most numerous being in the case of acupuncture. The effectiveness of acupuncture remains in dispute in scientific literature. The emerging clinical evidence seems to imply that acupuncture is effective for some but not all conditions.²⁸ In several cases, suggestions have been made that positive results can be attributable to the placebo effect.²⁹ Recent experiments on mice show that acupuncture therapy stimulates the release of adenosine which is a numbing agent to give pain relief.³⁰

Acupuncture therapy (both traditional and medical) is directed at specific areas commonly known as *pressure points*, *acupoints* or *nodes*, where there are fine branches of vessels (arterioles, venules and capillaries) and related nerves that supply nutrients to the various parts of the body. Therefore acupuncture is a point-specific methodology.

The other modalities of TCM-based herbal therapy and qigong are more holistic. They improve overall circulatory health but the evidence are even more scarce, with much of the explanations still based on the *energy-meridian* concept. However, being of a more holistic approach, they would be complementary to acupuncture therapy.

TCM contribution to modern medicine

TCM has largely been unchanged since the time of *Huangdi Neijing*. Once it is accurately translated, it is surprisingly parallel to the understanding of modern physiology, which one may argue, adds little to modern medicine. We do not need the metaphysical representation in terms of *energy-meridian* system which could be a misrepresentation of the original texts; as it is handicapped by the lack of scientific evidence to support this concept.

Amidst all the controversy, TCM does take a more holistic approach to conventional medicine with a greater emphasis on harnessing the body's natural healing ability. It may not be able to add much to modern science but it takes on an important role that modern medicine has largely neglected – presenting itself as preventive medicine by taking a holistic approach. With that, mainstream medicine should not dismiss it but embrace the principles as complementary – not necessarily as alternative therapy.

Many medical practitioners already do this, particularly those who have either come from a culture that already embraces this philosophy (the Chinese) or those who recognize the merit of TCM as being complementary, or those that appreciate the specific qualities of one of the modalities of TCM.

Intranasal Light Therapy as the bridge between TCM and modern medicine

As expounded earlier, the body cannot function well without a strong circulatory system. More specifically, the blood circulatory system performs the following important functions:

- Supply of oxygen to tissues (bound to haemoglobin, carried in RBCs)
- Supply of nutrients such as glucose, amino acids and fatty acids. These are dissolved in the blood or bound to plasma.
- Removal of waste such as carbon dioxide, urea and lactic acid.
- Immunological functions, including the circulation of white blood cells and the detection of foreign material by antibodies.
- Blood clotting or coagulation as part of the body's self-repair mechanism.
- Performing messenger functions, including the transport of hormones and the signalling of tissue damage.
- Regulation of body pH (measure of acidity).
- Regulation of core body temperature
- Hydraulic (fluid mechanical properties) functions, and several more functions.

Within the limits of scientific knowledge at the time it was written, *Huangdi Neijing* provided a deep appreciation of the importance of a blood circulation and why it is necessary to allow the system to perform at an optimum level.

Based on the above, as well as the overall arguments to this point, there is an opportunity for a modality that improves blood circulatory health without medication. It bridges the concept of TCM as well as modern medicine. Better still, if there is supporting scientific evidence as we enter the age of evidence-based medicine (“EBM”).

Intranasal Light Therapy slots easily into this role as the bridge between TCM and evidence-based modern medicine.

In a recent landmark study, Timon Liu et al conducted a randomised, double-blind, placebo-controlled study to demonstrate that Intranasal Light Therapy improves key risk factors that of vascular diseases. Factors that affect blood circulation, such as viscosity and RBC aggregation were found to improve with regular treatment. In addition to that, the profiles of important risk factors such as low density lipoprotein (“LDL”), high density lipoprotein (“HDL”) and triglycerides also improve.³¹ This is translated into indications that high blood pressure and high cholesterol conditions are expected to improve through regular use. There are numerous evidence supporting the modality for other diseases and disorder, largely based on its ability to

stimulate the body to restore homeostasis or optimum internal balance. Some of these can be viewed at www.mediclights.com.

The technology in its form factor

The Intranasal Light Therapy device, pictured below is a hand-held portable non-invasive blood irradiation device using the low level laser light (“LLLT”).



Figure 3: Intranasal Light Therapy device

In using this unique device, the nose-clip applicator delivers low level light into the vascular rich capillary bed in the nasal cavity for 25 minutes, as illustrated below. Any young adult can self-administer it without supervision. There is no feeling of any noticeable discomfort

The method of illuminating the nasal cavity to achieve the efficacy is patent pending. It is non-invasive and requires no special training to use.



Figure 4: Using the Intranasal Light Therapy device

Illustration of the effect on blood

The effect on blood may be better understood when visually observed although scientific data is also available in the literature. The change in the RBC aggregation can easily be observed in small blood samples taken before and after each 25-minute session under a microscope.

The picture in Figure 5 was taken before the treatment, and the one in Figure 6 after the treatment.

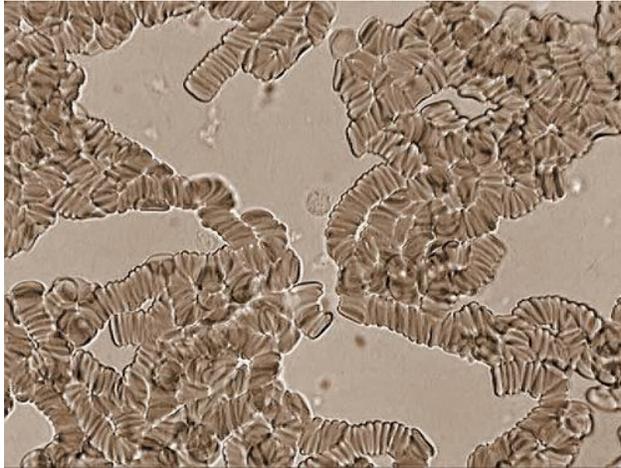


Figure 5: Blood sample before using the device

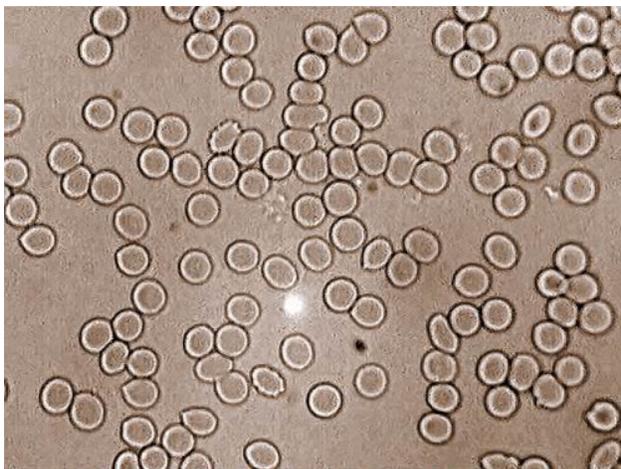


Figure 6: Blood sample after using the device.

More evidence captured in video can be viewed at this hyperlink - <http://www.youtube.com/watch?v=nfUQNJWDFqQ>.

Why the nasal cavity

The nasal cavity is as good as anywhere else in the body if we seek to illuminate the blood and then expect the effect to be rapidly circulated throughout the body. It is also non-invasive. Just beneath the thin walls surrounding the nasal cavity is a rich vascular capillary bed. These capillaries are specifically designed for rapid passage of fluids through the vascular wall and out into the dry air.³² The vascular walls in this region are particularly thin and sensitive, making them highly receptive to any biostimulation. The amount of blood flow to this area is considerable, and it is higher per unit of tissue than the blood flow to the brain, liver or muscle.³³

The concentration of blood vessels in nasal area is illustrated in Figure 7 below.

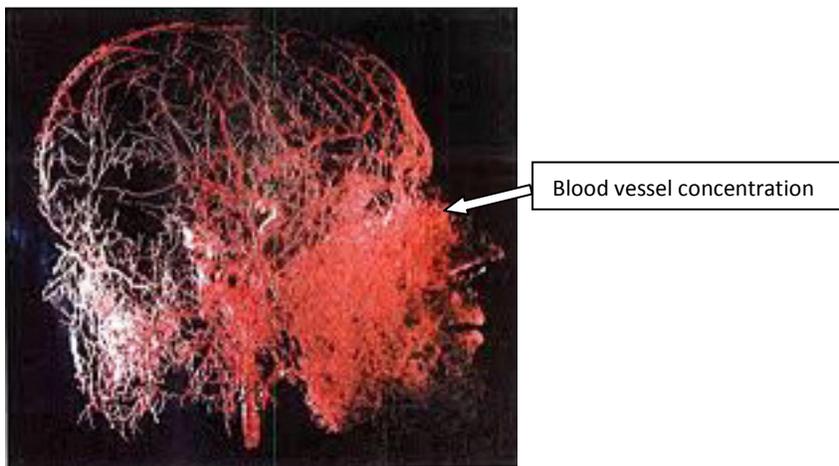


Figure 7: Blood vessel concentrations in the facial area

The key is in delivery of correct wavelengths under controlled dosage

Discussions on the detailed rationale behind the chosen wavelength and dosimetry are beyond the scope of this paper. The product specifications can be viewed on the webpage: <http://www.vielight.com/further-product-information/>. The specifications are designed to draw mechanisms as explained in this paper: <http://www.mediclights.com/wp-content/uploads/2011/10/Biostimulation-Mechanism-with-Intranasal-Light-Therapy-09-11.pdf>.

The scientific bases that govern the specifications have already been established over decades. The innovation of the Intranasal Light Therapy method is providing a simple, non-invasive method of delivering the efficacy directly into the body.

Conclusion

Based on more precise translation of the classical text, *Huangdi Neijing*, the objective of TCM with regards to Qi and Blood in the context of today's medical knowledge, is to ensure that oxygen in the blood is circulated throughout the vascular network in the body unimpeded.

TCM's holistic approach to medicine is credible in offering itself as complementary to modern medicine. Its focus on the blood circulatory system should be appealing – take care of that and you take care of most of your health issues.

However, in the eyes of skeptics, the traditional Chinese modalities of acupuncture, qigong and herbal therapy remain largely short of credible evidence to support their efficacy other than for pain management in the case of acupuncture. This opens the door to a new non-pharmacological approach that is true to the traditional holistic approach in improving blood circulation, and yet has acceptable scientific basis and evidence.

The Intranasal Light Therapy pathway bridges the philosophy of TCM and evidence-based modern medicine. TCM's emphasis on blood circulatory health and internal balance of "Qi" is satisfied by this modality. To satisfy the scientific skeptics, the supporting scientific bases and credible evidence are sound and continue to grow.

The fulcrum to good systemic health is described as *homeostasis* in biology, and the balance of *yin* and *yang* in TCM. Viewed from both seemingly different philosophies, Intranasal Light Therapy significantly succeeds in stimulating the body to migrate to this important systemic balance, resulting in overcoming many medical conditions. Hence it succeeds as the bridge between TCM and modern medicine.

APPENDIX 1

The Relationship between Blood and Qi in Popular TCM

The discussion here is based on the common contemporary understanding of Blood and Qi based on Traditional Chinese Medicine (“TCM”). Much of this understanding is based on a popular interpretation of the 2,000 year old classical work, Huangdi Neijing.³⁴ For purposes of discussion we will still refer this interpretation as “popular TCM”, which is arguable different in many key aspects to those presented in the main body of this paper which is largely based on Kendall’s more accurate translation.³⁵ Popular TCM has been permeated with the *energy-meridian* explanation originally postulated by Soulie de Morant.³⁶

There are various versions of TCM being presented. A popular interpretation believes that in relation to Blood, Qi has three main functions, as follows:³⁷

1. Generating Blood: This means that the generation of Blood depends on Qi. Blood is composed of Body Fluids (saliva, gastric fluid, intestinal fluid, joint cavity fluid, tears, nasal discharge, sweat, urine, etc.) and Nutritive Qi. They are from food processed by the activities of Spleen Qi and Stomach Qi. We need these Qi activities to firstly transform the food into Food Essence, then into Nutritive Qi and Body Fluids, and finally ending in the formation of Blood. Without all these Qi activities, there would be no Blood.
2. Moving/propelling Blood: This means that Blood, a *yin* substance which is motionless in nature, depends on Qi for its movement. To be exact, the Heart Qi moves Blood by maintaining the beating of the Heart; the Lung Qi pushes and disperses Blood; and the Liver Qi helps to regulate the free flow of Blood. When Qi is weak the Blood flow will become sluggish signalling that Blood Stasis is occurring.
3. Controlling the flow of Blood: This means that Qi (mainly the Spleen Qi) functions to keep Blood flowing within the vessels to prevent haemorrhaging.

According to TCM, Blood has the following physiological functions:³⁸

1. “Nourishing the body: If the Blood circulates ceaselessly, it fully nourishes the entire body and enables the discharge of waste. Therefore, Blood is an essential requirement for the maintenance of life.
2. Nourishing and fostering the spirit: Blood is the basic material supporting the human “essence” spirit (i.e. mental/emotional) activities. The heart controls the Blood. It also governs the spirit and orientation. When the heart is nourished by Blood, the spirit becomes clear and sharp. In mild cases of abnormal blood condition, heart palpitations and forgetfulness may occur, alongside a weakened immune system.
3. Maintaining the balance of *yin* & *yang*: Blood pertains to *yin* and Qi pertains to *yang*. Disease cause changes in the Blood properties, leading to the imbalance of *yin* and *yang*.
4. The reproductive function: When Blood is strong, the man or woman is fertile.

According to TCM, all the above clearly demonstrates that the Blood has a very important role in the maintenance of life activities.”

Blood also has the following effects on Qi:³⁹

1. Blood generates Qi: Blood provides the “essence” for the production and functional activities of Qi. This essence is the basis for the production of all the various kinds of Qi in the body. Hence the ancient saying, “Blood is the mother of Qi”.
2. Blood carries Qi: Other than being the “mother”, Blood is also the carrier of Qi and Qi is the “transporter” of blood throughout the body. If Qi does not reside within the Blood, it will float about aimlessly. Hence the saying, “Blood is the dwelling place of Qi”.

In summary, Qi is the “commander” of Blood, while Blood is the “mother” of Qi. Blood is yin and Qi is yang and both are interrelated. Qi is blood without form, while Blood is the form of Qi. The Blood includes Qi within it. Therefore Qi and Blood are interdependent and circulate together in the body. If Blood and Qi are not in harmony, then the body will succumb to diseases.

That is the contemporary popular TCM understanding of Qi and Blood.

Literal study of *Huangdi Neijing*

A study of the classical texts by Kendall states that the most critical role of blood is the distribution of vital substances (which includes qi – air/oxygen) and body fluids. Increased formation and circulation of blood can lead to increased levels of oxygen, nutrients, and functional activity. Similarly, an increase in the formation of these vital substances and body function has a corresponding effect on blood. The opposite would be true when there is a deficiency in blood.⁴⁰

APPENDIX 2

Effect of RBC aggregation on blood circulation and tissue perfusion – by Baskurt and Meiselman

The following is extracted from a review of evidence-based work on RBC aggregation by Baskurt and Meiselman.⁴¹

Effect of RBC aggregation on microcirculatory blood flow.

In studies employing intravital microscopy it has been observed that intensified RBC aggregation increases microvascular flow resistance.⁴² RBC aggregation in arterial and/or capillary microcirculation would affect the bulk viscosity of blood in larger blood vessels and the increased energy cost of disaggregation at the entrance of microcirculation.⁴³

RBC aggregation has also been found to decrease the density of functional capillaries, resulting in decreased overall microcirculatory blood flow. This is found to be especially significant under reduced arterial pressure.⁴⁴ Enhanced RBC aggregation also fills capillaries with non-flowing RBC making these capillaries dysfunctional.⁴⁵

Effect of RBC aggregation on venous flow resistance

The venous side of the circulatory system returns deoxygenated blood back to the heart and lungs to discharge the waste and carbon dioxide. Blood flow in the venous circulation is characterized by lower shear rates (change in velocity of blood flow parallel to vascular walls) compared to the arterial side. For this reason occurrences of RBC aggregation are more significant in the venous circulation areas.⁴⁶

Experiments show that normal RBC aggregation significantly contributes to venous vascular resistance in resting muscles and plays a significant role in vascular system homeostasis (stable bodily state).⁴⁷ It has also been demonstrated that RBC aggregation affects velocity profiles in venous blood flow, especially under reduced flow rates.⁴⁸ The energy loss caused by RBC aggregation contributes to flow resistance.

Effect of RBC aggregation on whole organ perfusion

A study isolated a rat's heart and then perfused it with a different concentration of dextran (a compound often used by researchers to simulate RBC aggregation). The results suggest that relatively low levels of RBC aggregation may reduce flow resistance in the organ, whereas greatly enhanced aggregation greatly increases resistance to blood perfusion to the organs.⁴⁹

Effect of RBC aggregation on tissue hematocrit

At the tissue level, tissues are also adversely affected when they are not properly provided with nourishing blood. They are served by the network of capillaries; and as discussed, if the flow is impeded by RBC aggregation, their condition will be adversely impacted. There are however, specific studies that look into tissues: more specifically on hematocrit (the ratio of blood volume occupied by RBC). Tests demonstrate that alterations in RBC aggregation induced by fibrinogen infusions affect tissue hematocrit values in rat myocardium (muscular middle layer of the wall of the heart).⁵⁰ These experiments were also repeated using more recently developed poloxmer coating method to alter RBC aggregation. These confirm that enhanced RBC aggregation alters myocardial tissue hematocrit values.⁵¹

Summary

In summary there is substantial evidence to show that RBC aggregation impedes blood flow. The presence of RBC aggregation affects microcirculatory blood flow, venous flow, whole organ perfusion, and tissue hematocrit.

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