Recent Advances in Cosmetic Dermatology in Asians

Dr. Henry HL CHAN
MD(London), PhD(HK), FRCP(London, Edinburgh, Glasgow), FHKCP, FHKAM(Medicine)
Honorary Professor, LKS Faculty of Medicine, The University of Hong Kong
Visiting Scientist, Wellman Center of Photomedicine, Harvard Medical School, Boston, USA
Specialist in Dermatology

Abstract
Asians differ from Caucasians as photoageing tends to present with pigmented changes as the main issue. Furthermore, with a higher epidermal melanin context, there is a greater risk of complications especially post-inflammatory hyperpigmentation and such high epidermal melanin context also acts as a competing chromophobe for the underlying target. In this review article, recent advances in the area of skin rejuvenation in Asians as well as new technologies for skin tightening and body contouring will be discussed.

Introduction
The global financial crisis in 2008 did have an impact to the development of medical devices in cosmetic dermatology. Many companies merged to reduce cost and some unfortunately went into bankruptcy (such as Rhytec-the company that developed plasma skin rejuvenation technology). Furthermore, most companies delayed the introduction of new technologies in such time of uncertainty which also implies that there are relatively fewer recent advances in cosmetic dermatology. Nonetheless, there are several new developments and this article will discuss such development in the treatment of acquired pigmented disorders; fractional resurfacing; non-invasive skin tightening and body contouring.

Treatment of Acquired Pigmentary Disorders

Freckles and Lentigo
Many lasers and light sources can be used for the treatment of freckles and lentigines. Q-switched (QS) lasers employ quality switching, a technology that involves the use of an electromagnetic switch to abruptly stop the laser from passing through the cavity and when the blockage is then suddenly removed, laser pulses with extreme short durations (in the nanosecond range) and high energy (1,000,000 W/cm\(^2\)) are produced. QS lasers can be most effective for the treatment of freckles and lentigines especially in light skin patients. However, previous studies indicated that post-inflammatory hyperpigmentation (PIH) can occur among Asians as QS lasers produce excessive tissue response due to their high energy and therefore resulted in greater degree of inflammation which in Asians is translated to a higher risk of PIH\(^1,2\). To reduce such risk, long pulsed pigment laser and intense pulsed light source have been used and lower risk of PIH can be obtained. Recently, the technique of compression window to empty the blood vessels and in doing so, reduce the risk of purpura has been advocated\(^3\). The purpose is to reduce haemosiderin deposition that can arise as a result of purpura post-laser treatment. Haemosiderin deposition can also contribute to the appearance of post-inflammatory hyperpigmentation in Asians. More recently, the concept of contrast between lesional and non-lesional skin in the treatment of lentigines among skin of colour is introduced. Unlike, light-skin patients whereby such contrast is great, complication is uncommon. However, for Asians or skin of colour when such contrast is low then issues occur especially when one uses a large spot size device. To avoid complications with a large spot size device, the operator has to reduce the fluence and often clinical efficacy is compromised. If the operator wishes to obtain better efficacy and push up the fluence, above threshold injury can take place leading to rather undesirable effects. Such hypothesis was validated in a recent retrospective study looking at forty Chinese subjects with lentigines treated with four different devices\(^4\). The long pulsed pigment laser with a compression window and small spot size achieved the greatest degree of improvement and least complication (Figure 1).

Melasma
Treatment of melasma remains the main challenge and while low fluence large spot size QS 1064nm Nd:YAG laser, otherwise known as laser toning or laser facial, had been advocated to be effective in the treatment of melasma, it is not without adverse effects. A recent article that has been accepted to be published reported 14 Hong Kong women that developed punctate depigmentation as a result of frequent treatments with this laser\(^5\). Looking at two recent published articles from Thailand and Korea, the risk of such complication is about 10% (5 out of 47 patients) after about 6 treatment sessions when one combined the
results of both studies. Clearly, laser toning should be considered as a second line therapy and only if patients are properly informed regarding potential complications.

Fractional resurfacing has also been used for the treatment of melasma and the new 1927nm thulium laser is being explored as a better option for the treatment of melasma. Our own experience, however, failed to confirm such observation and further studies to determine the optimal parameters are necessary before 1927nm thulium laser can be considered to be the treatment of choice for melasma.

Non-invasive Skin Tightening

Non-invasive skin tightening remains a popular cosmetic procedure given the lack of down time and complications associated with such procedures. Non-invasive skin tightening involves the delivery of energy source deep into 2-4mm of the dermis inducing collagen damage. The subsequent healing response can lead to skin tightening. There are several new developments in recent years that are worthwhile to mention.

Mono-polar radiofrequency has been used for non-invasive skin tightening since the last decade and is considered to be the gold standard for non-invasive skin tightening. Mono-polar radiofrequency involves the use of cooling to protect the epidermis and delivery of radiofrequency energy deep into the skin by attaching one electrode to the handpiece and the other to the trunk. The main drawback with this procedure is the pain associated which was considered to be severe among 5% of the treated subjects. The third generation mono-polar radiofrequency device was designed with the intention to reduce such pain. By incorporating a vibration handpiece into the system, it reduces pain based upon the gate theory. By creating vibrations, the neurological system is confused as both the pain and vibration senses are transmitted through the same neural fibre. Another new development is to divide the radiofrequency pulses into five with cooling pulses in between and once again the intention was to fool the neurological system. To achieve greater efficacy, the radiofrequency delivery was changed to allow dermal injuries with epidermal injury occurring first. Passage of radiofrequency creates epidermal and vibration sense transmitted through the same nerve loop. Another new development is to divide the radiofrequency pulses into five with cooling pulses in between and once again the intention was to fool the neurological system. To achieve greater efficacy, the radiofrequency delivery was changed to allow dermal injuries with epidermal injury occurring first. Passage of radiofrequency creates epidermal and vibration sense transmitted through the same nerve loop.

Focused ultrasound is another new technology that obtained United States Food and Drug Administration (US FDA) approval last September for eyebrow elevation. This device utilised a see-and-treat approach whereby the probe allows imaging of the tissue before application of the focused ultrasound, the energy of which is to be translated into thermal energy, deep into the target zone. In an Institutional Review Board (IRB) approved study (Western IRB, Seattle, Washington, USA), we conducted a company sponsored trial (Ulthera, Arizona, USA supported and provided indemnity) and examined thirty one Chinese patients for skin tightening. Efficacy and complications were assessed by two blinded observers as well as subjective structured questionnaires. Our data indicated significant improvement in the lower face with transient adverse effects including occasional bruises, mild oedema and transient dermal papules. While such results are promising, optimal parameters to achieve consistent clinical outcome and long term data are lacking. As a result, it cannot yet replace mono-polar radiofrequency as the gold standard for non-invasive skin tightening.

Fractionated Technologies

The concept of fractional photothermolysis has revolutionised the development of cosmetic technologies and many new devices are still being developed based upon this concept of inducing microscopic areas of injury with healthy tissue in between and thereby, allow rapid healing to take place.

The role of 1927nm thulium laser in the treatment of melasma has already been discussed. The advantage of this laser is that it has a water absorption coefficient that is 10 times that of 1550nm allowing more superficial thermal injury with up to 70% of the skin being removed during a single session. In our experience, in combination with 1550nm Erbium laser for skin rejuvenation, the dual approach can lead to more rapid results in skin rejuvenation and therefore better patient satisfaction (Figure 2).

In fractionated bipolar radiofrequency, multiple electrodes are mounted on the tip of the handpiece. Passage of radiofrequency creates epidermal and dermal injuries with epidermal injury occurring first and then dermal damage as a subsequent event. By alternating the parameters of the radiofrequency, sublative effects can be induced whereby there is more dermal damage with minimal epidermal disruption. The advantage of sublative rejuvenation is the lower risk of post-inflammatory hyperpigmentation especially in Asians. In our study that looked at 12 acne scar subjects treated monthly with this device, our preliminary data indicated significant improvement of acne scar with PIH rate of 1.9%, which is lower than previously reported PIH rate among patients treated with non-ablative fractional resurfacing.

Minimally invasive radiofrequency needles involve the insertion of radiofrequency needles into the skin and in doing so, induce significant focal thermal injury deep into the skin. Early results suggested it can cause skin tightening comparable to 37% of that obtained in a surgical facelift. This is indeed impressive and the commercial device should be available in Hong Kong in October 2010. The main issue is pain and post-
inflammatory hyperpigmentation and further study in our local population is necessary to determine its efficacy and risks.

**Body Contouring**

In August 2010, US FDA made history by approving two devices for non-invasive body contouring. Zeltiq (Zeltiq, Pleasanton, CA, USA) was approved for non-invasive fat layer reduction and Zerona (The Erchonia LipoLaser, manufactured by Erchonia Medical, Inc. McKinney, TX, USA), for reduction of the circumference of various body parts.

Cryolipolysis (Zeltiq, Pleasanton, CA, USA) is a novel technology that utilises heat extraction to remove energy from the skin and fat layer, cooling the tissue gradually and lowering the temperature at the subcutaneous layer to 4-8°C. This changes the triglyceride from liquid to solid state (triglyceride at body temperature is in a liquid state) and by maintaining such change for an hour, upon subsequent removal of the device, the triglyceride returns to the liquid state. Such alternation has been hypothesised to cause the adipocytes to go into apoptosis which occurs gradually over a 2 to 6 months period. A recent study indicated a reduction of 20% of the fat layer after 2 months and 25% after 6 months. Adverse effects are mild and transient including bruises due to the suction applicator, mild numbness that lasted for an average of 3 weeks and slight abdominal discomfort. Safety studies looking at the liver function and fasting lipid indicated no significant changes after the procedure and since its commercial launch in mid-2009 initially as an off label use (it was approved by US FDA for treatment of cellulite before current approval for fat reduction was obtained), cryolipolysis has been shown to be effective in localised fat reduction. Our own data indicated after a single treatment, 70% of the treated subjects found the results to be satisfied to very satisfied with 81% reported noticeable difference in the treated area (Figure 3).

Low energy laser (Zerona, Erchonia Medical, Inc. McKinney, TX, USA) was granted US FDA approval for non-invasive body contouring and was approved for reduction of the circumference of various body parts. The concept derived from the fact that in an in vitro setting upon exposure to laser at 635 nm with an output of only 2.5mW, after 6 treatment sessions within a two week period, there was significant reduction of total circumferences measured across the waist, hip and bilateral thighs. It was such kind of data that led to its FDA approval. However, in the author’s opinion there are several issues that need to be considered before readers rush out to purchase this device. First of all, tape measurement can be very inconsistent and to achieve repeatability, is very difficult. Second of all, an in vitro experiment differs significantly from an in vivo one. For the low energy laser to penetrate through the epidermis and the dermis and then affect the subcutaneous tissue is by no means easily obtainable especially among skin of colour given the high epidermal melanin context. Unlike light skin individuals whereby an optical window exists between 600 nm to 1000nm (and light source can penetrate deeper), melanin has a much wider absorption spectrum and for skin of colour, such epidermal melanin context will prevent any such kind of optical windows to exist. Finally, unlike in the US whereby the power output of a red laser pointer (635nm) is limited to 5mW, in other countries including Hong Kong, one can get high output laser pointers at a very reasonable cost. In fact, for 100mW 635nm diode laser pointers (almost 5 time the output of this device), the cost is about US$70. As a result, if such low energy laser is effective in non-invasive body contouring, then one can just give a powerful laser pointer to the patient to do it at home! Those particularly interested in this technology should also read the acknowledgement section (one of the most lengthy piece the author has ever come across) of the paper and draw their own conclusions regarding the study’s findings.

**Conclusion**

In conclusion, there are many new cosmetic procedures for the treatment of pigmentation, skin rejuvenation and body contouring. With the appropriate parameters, safe and effective treatments can be obtained in Asians. Careful assessment of the clinical data especially in their application to skin of colour is necessary before physicians purchase such device in their practice for clinical use.

**References**
