

Outlook of Plastic Surgery in the 21st Century

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Plastic surgery has come a long way since it was first performed by Sushruta in 600BC in India. The revolution of plastic surgery started after WWII in the 20th Century, along with advancements in other medical fields.

By the end of the 20th Century, the computer and mobile phone revolution had opened up many avenues for innovation and use of new technologies in health sectors, from early diagnosis to radical treatment and management. A brief account for existing and future developments and upcoming innovations, particularly in plastic surgery are as follows:

Robotics in Plastic Surgery:

Technical advances in field of surgery has shifted from large incision to minimally invasive surgery. In reconstructive plastic surgery, robotic techniques are increasingly being used to harvest muscle flaps for breast and head & neck reconstruction. This technique has also provided precision in microscopic nerve surgeries such as procedures on brachial plexus for harvesting fine nerves, grafting and repair. In the near future, robotics will be involved in more planning and will also measure performance of various surgical techniques. However, in the USA the most commonly used robotic system (Da Vinci) is still awaiting FDA approval for its use in plastic surgery.

Artificial Intelligence (AI), Virtual Reality (VR) and 5G Internet:

Possibilities for AI and VR are increasingly being explored in other specialities for better and accurate investigations in imaging and diagnosis, however they are still in their infancy in plastic surgery. Presently, AI and VR are mainly aimed to be utilised as simulator in training to surgeons for robotic surgery.

The deployment of 5G has been delayed due to the ongoing Covid-19 pandemic. However, in the recent World Economic Forum, 5G is predicted to change the world in the way we never imagine. Its capacity for real time data transfer, would greatly enhance touch and tactile functions through wearable medical devices such as VR devices. Its use in conjunction with AI, mobile phones and robotics would enable surgeons to see, interact, and perform complicated tele-plastic surgeries in remote and underdeveloped areas of the world.

3D Printing for Implants and Prosthetics:

Several small and large prosthetics are used by Plastic Surgeons, for example in ear, nose and chin, as well as small bone and joint replacement procedures which are mainly used in reconstruction, hand and facial cosmetic surgery. In the next few years, computerised and customised prosthesis can be designed which can be precisely made-to-measure and tailored to individual needs. Myoelectric arms and hands are already becoming increasingly common for amputees, providing excellence in controlling functions as well as providing cosmesis. It has greatly improved patients' confidence and quality of life.

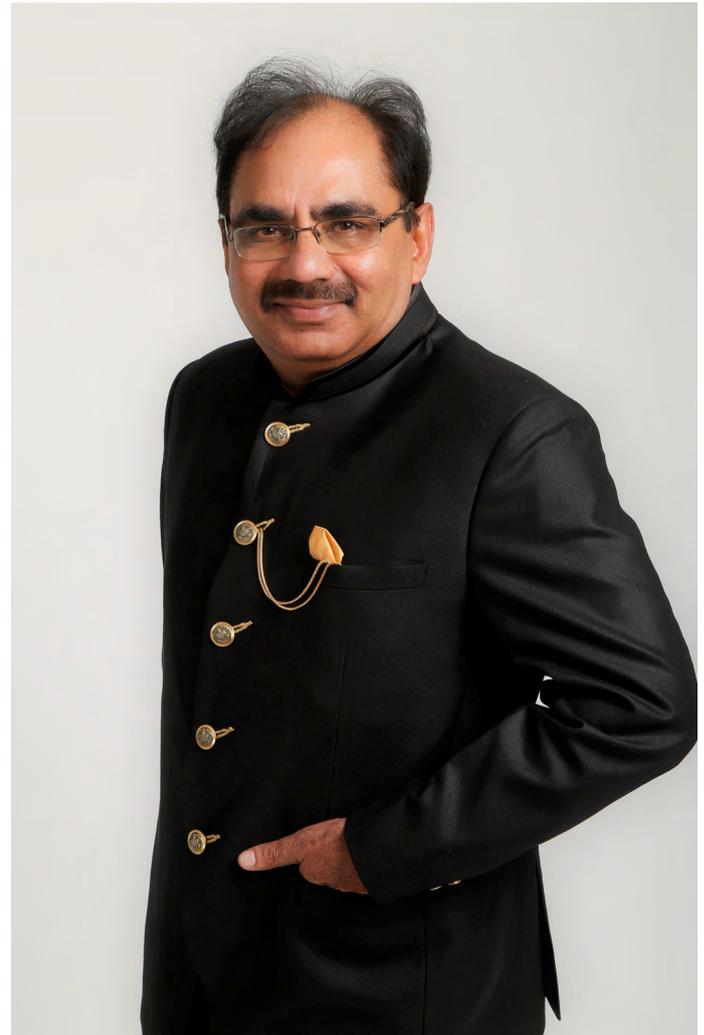
Customised 3D bioprinting modelling, mimicking the same facial features of patients, are being developed for facial transplant.

Similarly, replicas for hand transplants can be 3D bio-printed which can mimic hand functions and also improve cosmesis to increase patient satisfaction.

Surgical and Non-Surgical Cosmetic Procedures:

In the last decade, perhaps the most technical and pharmaceutical advancement has happened in the field of surgical and non-surgical Cosmetic procedures. People are becoming more aware of the benefits of a healthy lifestyle and are more conscious of their body morphology and looks. Innovations and technological developments in health and medical sectors enable early diagnosis and the advancement of treatments have resulted in increased life expectancy.

Increasingly available information over the internet and media hype have also fuelled the image of eternal youth. As a result, the desire to look young and energetic for longer has caused a constant and global surge in innovations and improvements in cosmetic non-surgical and surgical procedures.



Cosmetic surgery is considered to be the forte of plastic surgeons until a decade ago. Advancements in cosmetic non-surgical procedures have opened up a vast market for not only for surgeons from other speciality like ENT and eye surgeons but also for dermatologists and medical practitioners. With lack of regulations from various health controlling bodies a various country, now a days it is also being practiced by paramedics like nurses and physiotherapists and even beauty specialist. The paradigm for these procedures has extended from hospitals and clinics to beauty salons and spa centres.

Advancement in minimal and non-invasive procedures with almost similar results to surgical procedures has popularised non-surgical trends. The minimal or no surgical intervention with minimal complications and recovery time has attracted more clientele. The procedures are becoming more cost effective due to increasing competition and innovations amongst the machine manufacturers and pharmaceutical products. Non-surgical cosmetic procedures generally require return visits in most cases due to the temporary nature of the treatments as compare to lasting effect by cosmetic surgery. Still, the non-surgical option is more attractive to clients as it is less costly and avoids scarring and other complications associated with surgical procedures. Botox and dermal fillers are still the most performed procedures for rejuvenation worldwide. Biochemical products, such as stem cell injections, platelet rich plasma, collagens, growth factors and injectable vitamins, are also be used in non-surgical procedures and are increasingly being used alone or as part of other cosmetic rejuvenation procedures.

Over the last decade, social media and smartphone-based applications have made online video consultations easier. With 3D photography software, patients can visualise and choose their future face or target organ before proceeding with procedures. The ongoing Covid-19 pandemic has pushed digital and online advancements by allowing online communications and consultations to take place. However, it is crucial to improve the online content and regulate the quality of the information available in order to protect clients from unrealistic expectations associated with cosmetic procedures.

Autologous Breast Augmentation:

For many decades, autologous fat grafting (or 'lipofilling') are being successfully used to fill the bony and soft tissue contour deformities resulted by various reasons. Now, latest nano fat grafting techniques are becoming more popular both as micro filler such as in fine wrinkles and rejuvenation but also as mega filler for breast and gluteal augmentations. Nano fat grafting has advantages over normal fat transfer by using ultra micro cell size, contain more stem cells to ensure longer survival and also reduce complications. However, they are still not FDA approved in the USA as an alternative to breast implants, but they currently are being used to improve breast size and shape.

Minimal Invasive Face Lifts:

Extensive scarring post-face lift is now a thing of the past. There is increasing trend among Cosmetic Surgeons to adapt non-surgical methods as an adjuvant to include in their armamentarium. Newly evolving suspension technique for face-lift with bioabsorbable sutures combined with minimal incision face lift is producing great results and patient satisfaction.

Laser Procedures:

Advancement in various laser techniques is becoming widespread. This is not only used in eye surgery, haemangiomas and birthmarks but also in cosmetic procedures such as facial rejuvenation, liposuction and tattoo and hair removal.



Traditional invasive liposuction is being phased out in favour of improved ultrasonic, laser or radiofrequency techniques, as this lowers recovery times with less complications.

Conclusion:

The majority of techniques and innovations explained are still in their infancy. The current innovations in plastic surgery are very expensive to set up and maintain. Currently they are being practiced in very few specialised centres in affluent countries with benefits limited to a small proportion of the population. As these technological advancements become more refined in the near future, this will enable plastic surgery to become more cost effective and therefore be accessible to a larger proportion of people in more remote areas of the world.

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