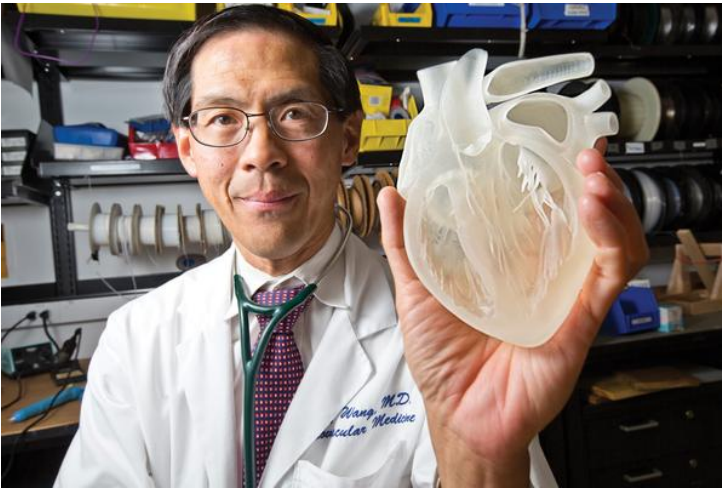


## 3D printing revolutionising Indian healthcare

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Indian market is considered as one of the fastest growing platform in almost every domain. Be it in technology or automobile or healthcare sector, India's domestic market is spreading its wings and exploring new available potentials. Recently introduced 3D printing technology is doing rounds in the Indian marketplace and is considered as the budding technology that is transforming the country's healthcare scene.

Hospitals in India are finding various applications for this technology. Be it prosthetics or strategy to treat a complex heart disease, the three-dimensional structures always come in handy. As 3D printing is becoming more popular in healthcare, there is a thriving industry catering to this sector.

3D printing is a digital manufacturing process that 'prints' three-dimensional objects, layer upon layer using a variety of polymers, metals and ceramics. The process takes digital files and converts it into a physical part.

Earlier, patients who needed prosthetics had to chip off the extra inches of bones in order to fit in the prosthetic but now with the help of 3DP technology each patient can get their own customised prosthetic. So, with the dawn of this era of customised prosthetics, patients can get a speedy recover as well as a better functioning body replacement.

3D printing is a revolutionary technique in which customised manufacturing of any design can be done with the help of CAD design that is then sent to specific devices called 3D printers which lay down material layer by layer and build a 3-dimensional product.

### The beginning

The technology is not new. In fact, it was first started in 1984 but then it was popularly known as Additive Manufacturing. 3D printing technology gained popularity in the last few years when experts realised that this could be a game changer,

especially in healthcare sector. The only hurdle was affordability as people who can be benefitted by this technology can't afford it as the cost was on the higher side. But recently, due to technological advancement and affordable printing devices, the cost has declined drastically and now 3D printing falls within the common man's reach.

Today, millions of invisible (transparent) orthodontic braces, study models, dental crowns, bridges, etcetera are made with the help of 3D printing. These are produced with the help of innovative industrial 3D printers which cost over a million US dollars.

On the advantages of 3D printing technology, Atit Kothari, Leadership Team - Head of Business Development, Imaginarium said, "3D printing, with its custom solutions, will have any system uplift its standard of living. With advanced manufacturing capabilities, it not only provides customised solutions to patients, but also makes possible very aesthetically pleasing components, so as to get rid of social stigmas associated with crooked jaw or a dented head."

Explaining the process, he said, "To provide patient specific anatomical models, we at Imaginarium Life use DICOM data (MRIs and CT scans) and convert them into exact replicas of a patient's anatomy. This can then be utilised by doctors for diagnosis and pre-operative surgeries. It not only helps a doctor better prepared, he or she also gains foresight to avoid any surprises during the surgery."

Imaginarium Life works with a variety of biocompatible material that can temporarily, or even permanently, come in contact with internal organs without any hazardous repercussions. A surgical guide is akin to a stencil for a surgery, where it aids the surgeon in making a cut or drilling the bone at very specific angles in a predetermined fashion, so as to make the most precise insertions, said Kothari.

### **Invaluable tool**

At Fortis Mumbai, cardiac surgeons use 3D printed replicas of the hearts of patients to strategise for complex procedures. Swati Garekar, a paediatric cardiologist said, "When I give the surgeon the model and say here is the patient's heart, he is so happy. It is the actual size which he will see in the operation theatre, providing an opportunity to really understand the anatomy of the patient's heart before opening up the chest".

Mahesh Kappanyil, a doctor with Amrita Institute of Medical Sciences (AIMS) said, "The technology has revolutionised the entire healthcare sector. There are plethora of surgeries and operations we can practice on the customised organs printed with the help of 3D printing technology."

3D technology has come as a breather for cardiologists in understanding the convolutions of heart that had often led to a bigger confusion on deciding best treatment possible. Recalling the old days, Dr Kappanyil said, "Over the past few years, I used to study the MRIs, CT scans and build models of heart by my hand using modelling clay, so that I could discuss with my team and understand the three-dimensional heart structure."

However, the introduction of 3D printing in the field of cardiology has not only put an end to the crude way of understanding the anatomy of various hearts, but has also increased the comfort level of surgeons in dealing with various complexities.

### **Cost factor**

Firoza Kothari, Co-founder and CTO of Anatomiz3D, a supplier of 3D printed models said, "3D printing allows the selection of best surgical plans. It also saves operating time, reduces blood loss, and reduces anaesthesia time and speeds up recovery. This leads to an overall reduction in the cost of operation".

On affordability of 3D technology, Atit Kothari said, "While 3D printing does add to the cost of surgery, it can also potentially bring down costs in terms of operation time, relapse surgery cost and other expenses which are not so direct. With 3D printing, we can achieve designs that are not possible to produce traditionally. Implants are designed in a way that's a perfect fit for osseointegration structures, and this helps implants integrate better with the body, minimising the chance for a relapse. With orthotics, the price is not exceptionally high and can be afforded by most. With prosthetics, 3D printed solutions are actually cheaper than the current solutions available."

Mukesh Doshi, a prosthetics and orthotics specialist and owner of POCL Medical Solutions, who has been providing 3D printed prosthetics to his patients for over a year now. As per Doshi, the technology doesn't require deep pockets and even a common man can opt for it. "The design is actually so simple that it works on strings which are attached to the wrist therefore giving us the biggest advantage of full movement of hands up to the fingers," he said, pointing out that they are extremely easy to maintain and affordable too. "A myoelectric hand with all finger movements costs around seven lakh rupees while the 3D printed hand costs only around Rs 20,000."

Though the market seems to be booming for the 3D printing technology but there are certain hurdles that are blocking its way. With the hype that is associated with 3D printing in today's age, people believe in the long-drawn myths. And more often than not, they are misleading. Battling these misconceptions and educating doctors and patients alike about what is possible with this technology can prove to be a task. "Many doctors follow the age-old view of "if it ain't broke, don't fix it". And this leads to only a fraction of them trying their hand at these new techniques. Most laws from the FDA and from the standpoint of the government are made for a high-volume-low-variety approach. Whereas where we come from, it's a world of medium to low volume and very high variety. It's unfortunate that a lot of these regulations restrict 3D printing in exploring and fulfilling its enormous potential," said Kothari.

### **Road ahead**

Certainly, 3D printing technology is a valuable lifeline for healthcare sector and in the long run, it will sprawl its reach and penetrate the Indian healthcare market deeper. It will also come handy in carving some of the best medical practitioners of the country as with 3D Printing, trainees can now work with printed anatomical models that thoroughly emulate a particular disease or diagnosis, making them more prepared than ever. All these factors definitely prove that 3D printing technology has instilled new life in the country's healthcare sector and it will grow in multiple folds in the coming years.