



Role of Artificial Intelligence (AI) in Plastic Surgery

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Abstract

Artificial intelligence (AI) has changed the world and has made social life easier and productive. It has helped in therapeutic decision making and also allows doctors to stay up-to-date. We have used Alexa™ as a tool of AI and has studied the applications in plastic surgery. We have found it to be useful and makes information procurement easier.

Keywords: Artificial intelligence; Alexa™; Plastic surgery

Introduction

Artificial intelligence (AI) refers to machines capable of understanding and interpreting data, learning, and making decisions while adapting to circumstances [1]. The learning and problem-solving abilities of AI have been used for environmental monitoring, education, astronomy, and discovering new sources of energy [2,3]. Artificial intelligence and machine learning can be used in the medical field as both uses complex algorithms for management of a problem. Alexa™ is a voice assistant that was introduced by Amazon which has become very useful as it uses AI and machine learning for the daily activities. In this paper we are discussing about the application of Alexa™ as a tool of AI in plastic surgery.

Materials and Methods

This was a study conducted in the department of plastic surgery in a tertiary care hospital. The study was done by using Amazon Alexa™. The device is 9.91*9.91*4.21 cm in size and weighs 299.37g, and offers Wi-Fi connectivity and Bluetooth support. The device after switching on is used by downloading the Alexa™ app on smartphone or tablet and adding the device, and needs connection to internet to offer its services. The cost of the device is 3,500 to 9000 rupees. It was used by the patient side, by the nursing staff and by residents for various purposes from clearing doubts of patients, helping in dispensing of drugs, research work also. A detailed questionnaire was filled up by the patients, residents, nursing staff and assessment of the responses done (Table 1).

Table 1: Proforma.

Questions	Response			
	Yes	No	Total	Positive Response (%)
1. Do you find it easy to use Alexa™	16	0	16	100



2. Are you able to understand Alexa™	16	0	16	100
3. Were you able to talk with Alexa™ comfortably?	8	8	16	50
4. Where you able to find Alexa™ is able to retrieve information that you have asked	16	0	16	100
5. Do you feel Alexa™ is able to make your research work easier	14	2	16	87.5
6. Do you think Alexa™ can make useful suggestions for your research work?	10	6	16	62.5
7. Do you feel Alexa™ can make intelligent decision about patient care?	8	8	16	50
8. Do you feel Alexa™ can allow you to have better rapport with your patients	16	0	16	100
9. Do you think Alexa™ can keep a check on your patient while you are engaged with other work	16	0	16	100
10. Do you think Alexa™ can help you in making decision on patient management using machine learning	16	0	16	100
11. Are you able to interact with Alexa™ and clear doubts about drug delivery	16	0	16	100
12. Do you feel Alexa™ can give advice about patient management in emergency situation when the attending doctor is not available	12	4	16	75
13. Do you think Alexa™ makes your patient comfortable	14	2	16	87.5
14. Do you think Alexa™ can help you by with patient care by informing you about patient nursing protocols	16	0	16	100
15. Do you feel the voice of Alexa™ monotonous?	2	14	16	12.5
16. Do you feel there is a lag time for response when speaking to Alexa™	14	2	16	87.5
17. Do you feel Alexa™ can alert the doctor if anything becomes wrong with the patient/ yourself ?	14	2	16	87.5
18. Do you feel Alexa™ can allow for interaction with your family while you are at the hospital?	14	2	16	87.5

Results

Alexa™ is found to be very useful in patient care. Patients also found interaction with Alexa™ useful and helpful. Residents found it useful in imparting patient care and research activities. The disadvantages were that it took time for getting accustomed to the voice response, time for machine learning also needs consideration. The cost factor also limits its widespread use.

Discussion

Plastic surgeons often face clinical scenarios that have no clear-cut solution. Optimal treatment requires a decision model that integrates multiple influencing factors such as clinical and socio-demographic data but is also straight forward to use. Application of AI in plastic surgery starts from involvement in decision making in plastic surgery. Alexa™ can be used to make decision about various procedures as it involves machine learning and can be trained to respond to standard clinical scenarios by providing various verbal inputs. Machine learning (ML) includes multiple algorithms that learn from data and user response to achieve new insights about pre-existing data, develop descriptive models, and predict its outcomes [4]. It can help by searching for various standard guidelines on voice search especially in scenarios where

decision has to be taken very fast in operation theatre where the hands may not be free.

Traditionally, residents supplemented their clinical learning with lectures, conferences, and reading focused on evidence-based medicine. However, this may not be the most efficient format for learning due to the hectic clinical work, limited resources, and increasing amount of literature. AI can facilitate the acquisition of knowledge and reduce the time needed for extra clinical education. With the help of natural language processing, the burden of learning evidence based medicine can be shifted from residents alone to machine aided [5]. Alexa™ can be useful to residents (Figures 1-5) as it can search for research papers and necessary information can be sorted out, it can also integrate with various educational tools to allow for efficient resident training like Alexa™ linked operation theatre which light can help in surgery when single surgeon is operating.

Patient care begins with symptom analysis, arriving at a diagnosis, making a treatment plan and making sure the patient adheres to the same. Alexa™ is an integral part of the social life of a large share of humans and it can understand even subtle changes in the human voice which may point to any disease like a common flu or malignancy of the speech apparatus and ask the patient to see a doctor or take a regular prescription depending on

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the associated conditions of the patient. Alexa™ can remind about vaccination days, remind about medical appointments, drugs to be taken, follow up visits (Figure 2). Alexa™ can schedule meeting with family physicians, get prescription for monthly medications, make arrangements for medicines to be delivered door step. This is very important in old patients who suffer from various co –morbidity as well from Alzheimer’s or from poor memory.



Figure 1: ALEXA™



Figure 2: Role of Alexa™ in patient care.



Figure 3: Role of Alexa™ in nursing care.

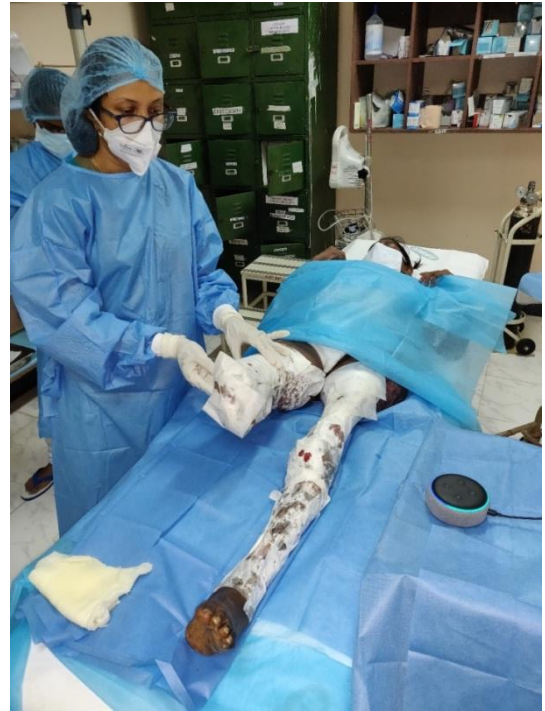


Figure 4: Role of Alexa™ in residency training.

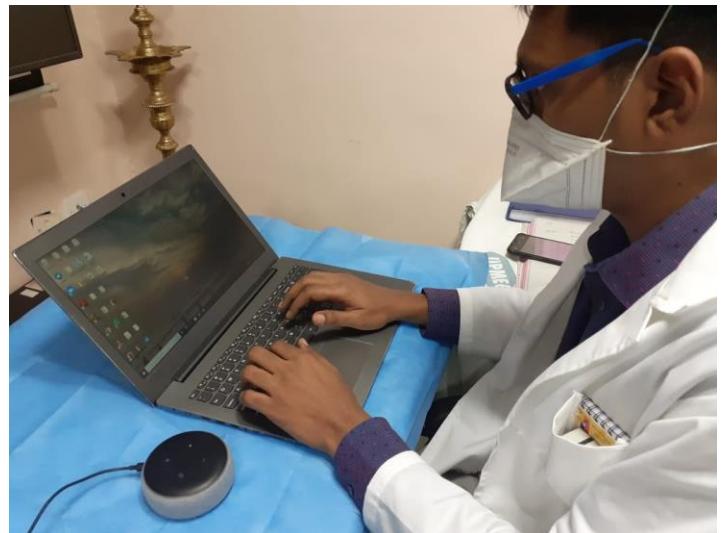


Figure 5: Role of Alexa™ in research.

Telemedicine is an important part of health care now. It involves shortening the distance from patient to doctor. Alexa™ can talk to healthcare worker and provide detailed description about patient symptoms, medications and adherence to same. Alexa™ can allow for accurate description of expectation of the patient from the treatment which is very essential for the practice of plastic surgery. It also allows the plastic surgeon to discuss about the various options and outcomes with the patient based on evidence, if Alexa™ is installed in the consultation room.

Alexa™ can become an integral part of the operating team if used judiciously. Alexa™ can provide real-time decision on the



various scenarios and how to tackle them if trained using machine learning (Figure 4). It can be integrated to imaging console and allows retrieving the patient data from online portal, and allows for immediate interpretation depending on previous experiences [6]. It can be used for pinpointing anatomical locations by using 3D imaging in the preoperative period and allows for accurate planning [7]. Alexa™ allows the surgeon to remember the standard steps as well as look for anatomical variances when found as it allows for hand free operation. In aesthetic surgery it can be used to assess the breast volume and allows for the assessment of the size of implant needed [8]. Alexa™ can also be used by the scrub nurse to keep track of the various counts, duration of the surgery, maintain patient safety checklist etc.

Alexa™ can be useful for postop care of the patient to assess the presence of pain, dosage of drugs to be administered, flap monitoring, positioning of the patient, allows to take post-operative rounds, to remind the nurse about regular medications of the patient (Figure 4). Alexa™ allows for follow up of the patient giving a record of activities patient is able to do after surgery, physiotherapy has been adhered to by the patient, schedule future visits to the surgeon.

In our study also we were able to find that the patients were able to use Alexa™ with ease, comfortable to use, handy and able to carry around. It was used for clearing their doubts about the medications prescribed, for social entertainment and relaxation also. The residents found it useful for their everyday work in the form of searching for recent guidelines, reading articles for presentation, studying operative methods and allow for quick revision as well. The nursing staff found Alexa™ useful for the dispersal of drugs, clearing their doubts about the drug dosages, allowed to remember the previous medication of the patient, physiotherapy sessions for the patient.

Although there is usefulness of the device in various spheres it suffers from some drawbacks as well, Alexa™ may be difficult to understand for the first time and the voice recognition for a new operator may also be difficult. There is a lag for machine learning and also for pattern recognition. The cost may not allow for the widespread use in developing countries.

Conclusion

Alexa™ can become an important part of providing healthcare provided it is used judiciously. Alexa™ can help the patient, surgeon, nursing staff, and resident in various fields of medicine. However detailed large scale studies may be needed to know how much Alexa™ can impact the practice of plastic surgery and its various uses in practice of medicine.

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