



Microstrip Patch Antenna Design for Early Breast Cancer Detection

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Abstract: Breast cancer is one of the leading causes of death among women all over the world. It is the abnormal growth of breast tissues in multistage process. As the stage increases, the chances of treatment and probability of survival of patient decreases. Hence, early detection and diagnosis of breast cancer is must. Microwave imaging technique for early detection of breast cancer is a promising technique to detect tumor and it also have several advantages over other existing techniques for breast cancer detection, such as Breast Self-Examination (BSE), Clinical Breast Examination (CBE), Breast Ultrasound, Computerized Tomography (CT), Magnetic Resonance Imaging (MRI), Positron Emission Tomography (PET), Mammography and other breast screening methods. One of them is non-ionizing radiations. Other advantages include portability, inexpensive system and safe for human body. Microwave imaging employs microstrip patch antenna as its integral part, for transmitting and receiving microwaves. Microstrip patch antenna as name suggests is a low weight, smaller size antenna. Depending upon substrate material, microstrip patch antennas can be categorized as flexible and non-flexible antennas. Flexible microstrip patch antennas, mostly consisting of textile materials are becoming the preferred choice for most of the researchers. This paper presents recent trends in microstrip patch antenna design for early breast cancer detection and a comparison among them in terms of substrate, feeding techniques, Specific Absorption Rate (SAR), E and H field, Return Loss, Voltage Standing Wave Ratio (VSWR) and some other parameters.

Keywords: Breast Cancer, Microwave Imaging, Textile Antenna, Wearable Antenna.

I. INTRODUCTION

Cancer is the second leading cause of death worldwide, and according to World Health Organization (WHO), it is accountable for most of deaths. Cancer is a name given to a large group of disease characterized by the growth of abnormal cells beyond their usual boundaries, in multistage process. These cells then can spread to other parts of body, causing the whole body to be affected. There are some of most common types of cancer: Lung Cancer, Breast Cancer, Colorectal, Prostate, Skin cancer, Stomach Cancer etc. A tumor can be divided into two categories, benign or it becomes difficult to save the life of patient. Hence early detection is all important for the survival of patient. For current work, breast cancer, analysis of techniques to detect it and microwave imaging as an emerging method for early breast cancer detection, is considered.

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This paper presents the survey of different breast cancer imaging techniques, advantages of microwave imaging over these techniques, then wearable and non-wearable microstrip patch antennas for biomedical applications and for breast cancer detection.

II. BREAST CANCER

Breast cancer is one of the most common death causing cancer among women all over the world. The term “breast cancer” defines a malignant tumor that has developed from cells in the breast. With time, cancerous cells can occupy nearby healthy breast tissue and make their way into the underarm lymph node. Once they get into the lymph nodes, then they have a pathway into other parts of the body. There are four stages of breast cancer. The breast cancer stage states how much the cancer cells have spread beyond the original tumor. Chances of cure and survival decreases as stage of cancer increases from 1st to 4th. At 4th stage cancer spread beyond the breast and to other parts of body, most commonly it goes lungs, bones and it also spreads to brain. Therefore, early detection of breast cancer is indispensable for fast cure and survival of patient.

III. BREAST CANCER DETECTION TECHNIQUES

The cancer imaging technique is decisive or crucial for early breast cancer detection. There are several cancer imaging techniques that are currently in use such as Breast Self-Examination (BSE) and Clinical Breast Examination (CBE), Breast Ultrasound, Computerized Tomography (CT), Magnetic Resonance Imaging (MRI), Positron Emission Tomography (PET), Mammography and other breast screening methods. However, these techniques are currently in use, but still have some weaknesses. PET is not effective for primary tumor detection. Mammography is considered as gold standard for breast screening, but it is ineffective in younger women and for those with dense breasts. X-Rays causes breakage of human body cells and tissues, magnetic rays involved in MRI has poor imaging capabilities for superficial soft tissues[1],[2]. Mammography involves ionizing radiations and has slow imaging time and is non-portable [2].

From comparative analysis of above-mentioned techniques presented in [2], advantages and limitations are shown in following Table 1[2].

IV. MICROWAVE IMAGING

Microwave Imaging (MI) to detect breast tumor is a promising method to overcome the issues with techniques mentioned in section III. It has low cost, non-ionizing radiations, high sensitivity in detecting tumors, and

Table 1 Existing Breast Cancer Detection Techniques

Breast Cancer Detection Techniques						
	Examination-based		Conventional imaging-based			
	BSE	CBE	Mammography	Breast ultrasound	PET	Breast MRI
Advantages	Used for high risk population, easy and convenient to use	Mortality rate can be reduced	Less imaging time, resolution is good, easily portable device	Wide availability, noninvasive, lower costs, painless	Provides anatomical or functional information, good contrast	High spatial resolution, no radiation exposure, can better detect spread of cancer
Limitations	Have no effect on mortality rate, harmful	Does not even determine malignancy	Limited dynamic range, ionizing radiations are used, not good for younger women	Poor resolution, poor contrast, dependent upon the skills of physician	Non-portable, slow imaging time, use ionization radiations	Slow imaging time, non-portable, only lateral view is available, complex interpretation

provides comfort to patient. MI employs microstrip patch antenna for tumor detection. Microwave imaging is divided into two categories as Tomography and Radar based microwave imaging. Microwave Imaging (MWI) system, consists of a transmitter microwave system to emit signals inwards the breast and a receiver to detect those backscattered signals after they interact with the breast. The principle behind MWI, as shown in Fig.1, is the contrast between dielectric properties of tumors tissues and healthy breast tissue.

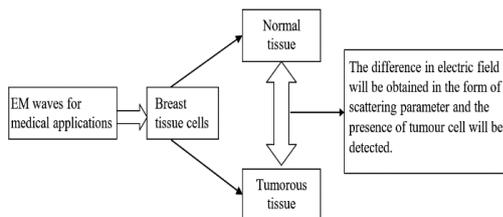


Fig. 1 Microwave Imaging Principle

V. MICROSTRIP PATCH ANTENNA

As discussed before, microwave imaging system consists of antenna to transmit and receive signals, hence, selection for antenna is very important. There are many types of antennas such as dipole, horn etc., but microstrip patch antenna has merits over these in terms of light weight, small structure, easy fabrication and low cost [6]. A microstrip patch antenna, as shown in Fig. 2,

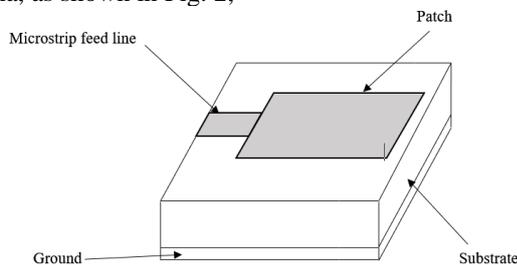


Fig. 2 Microstrip Patch Antenna

consists of a conducting patch on one side of substrate and a ground plane on the other side of it. Patch and ground are conducting materials whereas substrate is a non-conducting material with dielectric constant of less than 10 [7]. Microstrip patch antenna is an integral part of microwave imaging system, as it is used to transmit and receive microwaves involved. Further, microstrip patch antenna can be divided into wearable and non-wearable based on

substrate used. Now a days, textile substrates are becoming a first choice for wearable biomedical antenna as they provide comfort to the wearer and flexibility.

VI. RELATED WORKS

In this section, recently publicized and relevant papers for the current work are discussed. Discussion is divided into three parts based on wearable antennas for biomedical applications, antennas particularly for breast cancer detection and then performance enhancement of microstrip patch antennas. These research papers have been studied for various parameters of microstrip patch antenna and for size of tumor to be detected. Merits and demerits of each research paper are determined and various methods to get best results in the terms of Return Loss, VSWR, Impedance matching, E/H fields etc. have been examined.

A. Microstrip Patch Antennas for Biomedical Applications

Microstrip patch antenna is a substantial technical evolution tool which is applied in many practical medical applications, such as medical implants, wireless monitoring applications, microwave imaging and many other on body applications. In this context, M. Aziz Ul Haq et.al.[8], in 2014, presented a paper on study of Multiple Ring Slot Ultra-Wideband (MRS-UWB) patch antenna for biomedical applications. The proposed antenna with the ring slots was designed on FR-4 substrate and fed through a microstrip line by optimizing the width and position of the feed along with the width of partial ground structure. Stairs of rectangular slots were used in the feed line and there was corner truncation of ground plane. According to 10dB bandwidth criteria, the proposed antenna offers promising performance of UWB design ranging from 2-12 GHz. Maximum Return Loss (RL) occurs at 4.3 GHz, 5 GHz, 8 GHz and 11.6 GHz. For entire UWB range, the VSWR is < 2dB. This antenna was not tested practically, only simulation results of antenna itself were presented. Then in 2017, Shikha Sukhija et al.[9], presented a design of two-sleeve low profile antenna, operating in ISM band, for bio medical applications. This antenna was designed on FR-4 substrate and simulations were performed by making variation in length of first sleeve, second sleeve and ground plane, at different times.

Measurements were done by developing human tissue like materials. Two sleeves were proved to have great effects on antenna performance for ISM band. As microstrip patch antennas are being used for biomedical or on body applications, these should be smooth and provide comfort to the wearer. When using FR-4 as substrate, flexibility or wearability becomes a question. Taking this concept in mind, A Kavitha et al. [10], in 2019, presented the design of flexible textile antenna operating at 2.4 GHz, using FR4, jeans cotton and teflon substrates. From simulation results among the three substrates, it is observed that all the three antennas have their own good performance characteristics but teflon substrate is best suited for textile antenna design. In same year Prof. N.R. Ingale et al.[11], presented a design of textile antenna for on body communication. Two antenna structures were designed using cotton and jean substrate respectively. Textile substrate was placed on ground plane of copper sheet by using adhesive double tape. This adhesive double tape has negligible thickness. Both the antennas show good performance for on body applications. To improve the performance of microstrip patch antenna, array structure gives better results as compared to single antenna element. The double substrate and defected ground geometry play a vital role to improve the performance of antenna of interest. These techniques have been utilized by the following researchers. Syahirah Shawalil et al.[12],in 2019, presented an antenna array design for wearable applications. An inset fed microstrip patch antenna was designed and simulated. ShieldIT super and jean cloth were utilized as conducting patch and substrate material

respectively. Then a wearable textile microstrip patch antenna array was designed, fabricated and hidden inside the jean fabric. Simulation and measurement results show that the designed microstrip patch antenna array with two elements performs better as compared to single element antenna with same materials used, in terms of return loss. In the same year, Ameena Banu Mustafa et al.[13], presented a double flexible substrate antenna with defected ground structure (DGS) for healthcare monitoring system. Single substrate antenna structures were designed using Teflon and felt, with and without DGS. Then, same antenna structures were designed with double substrate. From simulations it was found that double substrate antenna with DGS perform better than other presented structures, in terms of Return Loss, Gain, Voltage standing wave ratio.

A comparison among different parameters of these papers is given in Table 2.

B. Microstrip Patch Antennas for Breast Cancer Detection

Microstrip patch antennas be an emerging tool for use in microwave imaging, which, transmits and receives backscattered signals. Researches are trying to get best results by designing a microstrip patch antenna using different designing techniques, different substrates, feeding techniques etc. In 2015, Rabia Caliskan et al. [6], presented an inset fed antenna structure for breast tumor detection. This inset fed rectangular microstrip patch antenna operating at 2.45 GHz, uses FR-4 as substrate.

Table 2 Microstrip Patch Antennas for Biomedical Application

Parameter	Substrate	Double Substrate	Feed	Operating Frequency (GHz)	Return Loss (dB)	Array	Flexibility
M.Aziz Ul Haq et al. [8]	FR-4	-	Microstrip feed	2-12	<-30	No	No
Shikha Sukhija et al. [9]	FR-4	-	Microstrip feed	2.45	<-10	No	No
A Kavitha et al. [10]	i) Jean cotton, ii) Teflon, iii) FR-4	-	Co-axial feed	i) 2.450 ii) 2.438 iii) 2.452	i) -17.42 ii) -13.93 iii) -19.39	No	Yes
N. R. Ingale et al. [11]	Cotton, Jean	-	Microstrip feed	2.45	<10	No	Yes
Syahirah et al. [12]	Jean	-	Microstrip feed	2.24 2.355(array)	-15.522 -24.10	Yes	Yes
Ameena Banu et al. [13]	Teflon, Felt, Jean	i) Felt, Teflon ii) Felt, Jean	Co-axial feed	2.42	i) -23 ii) -18	No	Yes

Some modifications in ground plane and slotting on radiating patch makes simulation results better. Five modified antenna structures are simulated with 3D breast model. Electric field, magnetic field and current density parameters show a detectable difference for simulation of proposed antenna with breast model having no tumor and with breast model consisting of tumor. A tumor radius of 20 mm was considered for simulations. Then in 2016, R. Karli et al.[14], proposed a miniature planar ultra-wide band microstrip antenna for breast cancer detection with operating frequency of 6 GHz. Cone shaped breast model was used. Antenna was simulated at various distances from the breast model and concluded that direct placement of antenna on the

skin may increase the sensitivity of tumour detection by Microwave Imaging. This antenna can detect tumor of radius 0.5 cm. Proposed antenna is well suited for Ultra-Wide Band Systems due to its compact size, single layer structure and large bandwidth. In February , 2017, Hemant Kumar Gupta et al.[15], designed a T-shaped slotted antenna for breast cancer detection. This FR-4 (lossy) substrate antenna resonates at 2.45 GHz. In designed rectangular patch antenna, T shaped slot was inserted for the improvement of parameters.



Microstrip Patch Antenna Design for Early Breast Cancer Detection

Two cases were considered. First, breast phantom model with tumor at center of rectangular microstrip patch antenna and second with breast phantom with tumor at 50 mm away from rectangular microstrip patch antenna. A significant difference was found in current density and SAR for breast phantom with tumor and without tumor. In [16], J. Joyselin et al., designed aslot loaded patch antenna. In this tumor detection was made in terms of variations in E and H field and in current density in the presence and absence of tumor in breast. Designed antenna shows a significant difference between above mentioned parameters. Suresh Subramanian et al.[17], in 2018, presented an investigation on simulation based Specific Absorption Rate in Ultrawide band (UWB) antenna for breast cancer detection. An octagonal shape UWB antenna with FR-4 substrate was designed. Its operating frequency ranges from 3 GHz to 15 GHz. SAR

was used to identify the tumor. SAR was simulated for various tumor sizes and for various locations. A significant contrast was found for breast model with no tumor and breast model with tumor. To improve the matching conditions a circular shape was etched from the patch. This also results in bandwidth improvement. In 2018, T.V.Padmavathy et al.[18], presented an I shaped dual C-slotted antenna for breast tumor detection. This antenna covers a frequency range of 4 GHz to 10 GHz. FR-4 substrate antenna was fed by single edge feed line. SAR value along with absorbed power, return loss and gain was used for the detection of tumor. These results were compared for breast model with tumor and without tumor. Table 3 shows the various parameters that were considered to detect breast cancer in above mentioned papers.

Table 3 Non-flexible Microstrip Patch Antennas for Breast Cancer Detection

Parameter	Rabia Caliskan et al. [6]	R. Karli et.al. [14]	Hemant Kumar Gupta et al. [15]	J. Joyselin et al. [16]	Suresh Subramanian et al. [17]	T.V. Padmavathy et al. [18]
Substrate	FR-4	FR-4	FR-4	RT-Roger 5880	FR-4	FR-4
Operating Frequency (GHz)	2.45	6	2.45	3.979	3-15	4.9-7.89
Feed	Inset feed	Microstrip feed	Microstrip feed	Microstrip feed	Microstrip feed	Single edge feed line
Antenna Size (mm*mm)	65.4*88.99	11.5*16	-	60*80	29*10	30*40
Current Density with tumor (A/m ²)	54.946	94.78,141.64, 787.86	1288	1332	-	-
Current Density without tumor (A/m ²)	68.15	-	107.3	1052	-	-
E-field without tumor (V/m)	170.38	-	-	25167	-	-
E-field with tumor (V/m)	137.36	-	-	25005	-	-
H-field without tumor (A/m)	0.84634	-	-	130	-	-
H-field with tumor (A/m)	0.786	-	-	129	-	-
Tumor Size (radius)	20 mm	0.5 cm	-	-	3,4,5 mm	20 mm
SAR difference for tumor and no tumor considered	-	-	Yes	-	Yes	Yes
Return loss (dB)	-	<-10	-24.104	-	-	<-37
Gain (dBi)	-	2.25-4.55	-	-	-	-
Distance between antenna and breast model	-	Different distances	-	1.4 mm	Different distances	-

Different researchers used various parameters to detect breast cancer at early stage as shown in Table 3. Tumor can be detected by variations in fields, SAR values, Current Density in the absence of tumor and presence of tumor. Sensitivity of tumor detection varies with distance between antenna and human breast phantom. Sensitivity of detection increases with decrease in the distance between antenna and breast phantom. Textile substrates are preferred by most of the researchers as these substrates provide smooth interface and comfort to the patient. In this context, in 2018, Fawzy Alsharif et.al [19], presented a novel design for wearable microstrip patch ultra-wideband antenna. The operating frequency of proposed antenna ranges from 1.6 GHz to 11.2

GHz. To support wearable property, 100% cotton has been utilized as a substrate with dielectric constant 1.6. Staircase structure was employed to get better Return Loss value. In 2019, Dhamodharan et al.[20], had presented a wearable antenna operating at 2.45 GHz for breast cancer detection. Antenna has overall size of 80*80 mm². Jean cloth with dielectric constant of 1.7 and thickness 1 mm has been utilized as a substrate to support wearability and to provide comfort to the wearer. Co-axial feeding method was used for the presented antenna, which improves the antenna performance.

Antenna performance is analyzed in terms of return loss, gain, radiation pattern, axial ratio and VSWR. I. Rexiline Sheeba et al.[21], proposed the design of flexible softwear antenna and its analysis for tumor detection in skin and breast. Two antenna structures operating at approximately 2.4 GHz were presented. One with hexagonal patch without slot and other with slotted hexagonal patch. Jean cotton was utilized as substrate for both structures. Two antenna structures were compared in terms of return loss, VSWR, gain and SAR. Then these were simulated for tumor detection in terms of current density. A comparison of parameters for textile microstrip patch antennas is shown in Table 4. Textile materials have very low dielectric constant values as compared to non-textile materials. This provides antenna bandwidth improvement and surface wave losses are reduced. Textile materials result in larger antenna dimensions [22]. This can also be concluded by analysing Table 3 and 4.

C. Antenna Performance Enhancement

Microstrip patch antenna performance depends on the characteristics of antenna element and substrate as well as the feed configuration used. This section of paper provides the analysis of various feeding structures, choice of textile material and choice of stacked patch or wide slot antennas. A good impedance matching is essential between transmission line and patch, this can be achieved using appropriate feed configuration. Feeding configurations are divided into two categories: contacting and non-contacting. These are Microstrip line and coaxial probe (contacting schemes), aperture coupling and proximity coupling (non-contacting schemes)[23]. Of all these microstrip feed is easiest. In microstrip feed, a conducting strip is connected to the patch and this can also be etched on the same substrate[23][24].

Table 4 Textile Microstrip Patch Antennas for Breast Cancer Detection

Ref. Parameter	Fawzy Alsharif et al.[19]	Dhamodharan et al. [20]	I. Rexiline Sheeba et al. [21]
Substrate	Cotton, Fleece	Jean	Jean cotton
Dielectric constant (Er)	1.6	1.7	1.6
Patch and Ground	Copper	Copper	Copper
Working Frequency	1.6-11.2 GHz	2.4 GHz	2.32 GHz
Patch Dimensions(mm*mm)	-	46*53	46.57*54.8
Ground Dimensions (mm*mm)	70*60	80*80	-
Feeding Technique	Microstrip feed	Co-axial feed	Microstrip feed line
Return Loss	<-10 Db	-35 dB	-32.67Db
VSWR (dB)	< 2	1.029	1.36
Antenna Gain (dB)	6.17	3	6.74
Gain (dB) without tumor	-	-	7.25
Gain (dB) with tumor	-	-	7.20
SAR	-	-	1.836 W/Kg
Tumor Size (radius in mm)	10 mm	-	-
Others	Staircase patch	Slotting on patch	Hexagonal patch and patch slotting

Of all these microstrip feed is easiest. In Coaxial feed, the inner conductor of the coaxial connector is connected to the radiating patch through the substrate and the outer conductor is connected to the ground plane. This feed can be placed at any location according to the requirement[23][25]. Aperture coupled feed consists of two substrates separated by a ground plane between them. Radiating patch is etched on the upper substrate while a microstrip feedline is etched on the bottom substrate, which is electromagnetically coupled to the patch by means of a slot in the ground plane in order to obtain aperture coupling[23][24]. Proximity coupled feed consists of two dielectric substrates such that the feed line is between the two substrates and the radiating patch is etched on top of the upper substrate[23]. Effects of all these feeds on various antenna parameters are shown in the Table 5 [23],[24],[25]. Substrate material selection for patch antenna is of great importance as it affects the performance of

antenna in various ways. Textile antennas are leading in the biomedical applications. There are a variety of textiles that can be used. In [26], Salvado et al. , provided the analysis of textile material selection for patch antenna. About 9 fabrics sand their impact on antenna performance was discussed. Cordura^R, fleece fabric and woollen felt were found as good candidate for patch antenna substrate. Pekka Salonen et al. [22], compared five different synthetic fabrics, Fleece, Upholstery fabric, Vellux, Synthetic felt and Cordura^R in order to determine their effects on wearable antenna performance. It has been shown that all these materials are suitable for wearable antennas. However, the mechanical elasticity can cause problems in maintaining the antenna’s electrical performance.



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It was found that CorduraR maintains its mechanical dimensions the best which in turn helps in maintaining the electrical performance of antenna. Further, its high water column resistance makes it very practical smart cloth. But at the same time its thinness creates problems when designing for wide bands. In [27], Pranita Manish et al., provides an investigation on material selection. Four textile materials cotton, polyesters, Lycra and coudura were considered. The overall performance of antenna engaging polyester fabric was found better as compare to other three. Which is due to low value of loss tangent that is 0.0045 with respect to other material. As wireless body area networks require antenna with high directivity, antenna with lycra and cordura material can be considered as good candidate for it. Anneleen Tronquo et. al. [28], proposed two prototypes to assemble textile rectangular ring antenna. Fleece was used for antenna substrate whereas electro textile Flectron was used to construct ground plane and radiating patch. The first prototype which employed the glue stick to attach the different layers to one another and additional stitching to obtain a uniform thickness is preferred where high gain antenna is required. The second prototype employed an adhesive sheet to assemble the antenna. This prototype is well suited when high performance transceiver and receiver are used, due to better contact between different layers and it also allows direct integration.

As the main concern of this work is about microwave imaging, so we require a wide band width antenna. Ragab M. Elsaygher et.al. [29], presented the study on bandwidth enhancement techniques of microstrip antenna. Three techniques were considered. That are, partial truncation of

ground plane, inserting slits in the radiating patch and use of different substrate materials in order to obtain band notched Ultra-Wide band. UWB of 8.3 GHz was achieved and it was seen that with decrease in dielectric value of substrate the UWB curve shifts towards the higher frequency. David Gibbins et. al. [30], presented a comparison of wide-slot and a stacked patch antenna for the purpose of breast cancer detection. When both the antennas were compared with respect to return loss, comparable performance characteristics were obtained. Results showed that the ultra-wide slot performed well in breast imaging, also the size of ultra-wide slot antenna was half the size of stacked patch antenna.

VII. RESULT

From survey, it is found that for on body applications, multiple ring slot antenna [8], is best. It provides optimum results in terms of parameters such as return loss, operating frequency and wide bandwidth, all with single antenna element. Moving to particular application, breast cancer detection, from non-flexible microstrip antennas, octagonal shape antenna [17], is found best. When compared to other antennas in its category, it provides best results in terms of smaller dimensions, wide bandwidth with operating frequency range 3-15 GHz. It provides detection of various tumor sizes for various locations. Now, for breast cancer detection with textile antennas, it is observed that all the textile antennas have larger dimensions in contrast to non-textile antennas. In textile

Table 5 Microstrip Patch Antenna Feeding Configurations

Parameter Feed → ↓	Return loss	Resonant Frequency	VSWR (dB)	Polarization	Ease of fabrication	Reliability	Impedance matching	Bandwidth
Microstrip feed	Less	More	<1.5	Poor	Simple	Better	Easy	2-5%
Coaxial feed	More	Less	1.4-1.8	Poor	Soldering and Drilling needed	Poor	Easy	2-5%
Aperture coupled	Less	Least	≈2	Excellent	Alignment required	Good	Easy	21%
Proximity feed	-	-	-	-	Alignment required	Good	Easy	13%

antenna category, cotton and fleece substrate antenna [19], is looking better, as it provides wide bandwidth for tumor detection and 100% cotton provides comfort to the wearer. All the three antennas mentioned in this section, uses microstrip feed line, which is easy to fabricate and is most reliable. These three antennas can be used as base for future work.

VIII. CONCLUSION

Several research papers based on recent research on design of microstrip patch antenna for breast cancer detection have been reviewed. Microwave imaging is found as a good alternative over other breast screening techniques. Human body exposure to microwaves is harmless. Microwave imaging is a safer and cheaper technique to detect breast

tumor as compared to other existing breast screening techniques. Then microstrip patch antennas, wearable and non-wearable antennas for breast cancer detection as well as for other on body applications have been surveyed. According to the reviewed papers, tumor size up to 3mm has been detected till now, but by making compromises with some other parameters such as antenna size, resonant frequency, distance between antenna and human breast. Most of the antennas are found working at single band. Dual band antennas can enhance the performance of microwave imaging, provided the working of antenna within Industrial, Scientific and Medical (ISM) band. Some researchers detect the tumor by making no distance between antenna and human breast.

It improves the quality of microwave imaging but at the same time it can be harmful for human skin tissues. Smaller size microstrip patch antennas can be converted into antenna arrays by combining more than one antenna element. Arrays provide scattered signal information more precisely, which results in better detection of tumor. It is found that less work has been accomplished on textile based microstrip patch antennas but now textile antennas are gaining the strong attention of researchers, due to their flexibility, smooth surface and comfort to the wearer. Although textile antennas provide some advantages over conventional non-flexible antennas, they also result in larger dimensions. Therefore, methods are needed to reduce the size of textile patch antennas without compromising the antenna performance. Most of the researchers used single parameter to detect tumor. Difference between more parameters can be considered for precise results, i.e. SAR value, E and H field, Return Loss, Current Density. Some methods to improve antenna performance in terms of return loss, bandwidth etc. have also been analysed and a comparison between them is provided so that user can use them according to the requirement.

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