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Various Methods for Analysis of Skin Diseases

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Abstract: Skin diseases like skin cancers, leprosy are untreated and mostly cause death. If the physician finds the appearance of lesion doubtful then normally visual inspection method is used for diagnosis but all malignant lesions are not identified through visual inspection. Visual inspection could help to prevent misdiagnosis of BCC and other skin diseases. Electrical impedance may distinguish skin cancer from other tissue. The electrical impedance of a tissue depends on its structural characteristics as well as its chemical composition. Studies have shown a wide degree of variation in the bio-electric properties between tissue and cells of body. Differences in electrical impedance of skin as a result of irritation, allergic reaction, location, sex, age and hydration. A small clinical study has also shown significant differences between affected skin and normal skin. Impedance measurement based on a comparison of indexes: magnitude, phase, real part and imaginary part index.

Keywords: Impedance analysis, Lesion impedance, Affected skin, Normal skin impedance, Skin diseases.

I. INTRODUCTION

There are distinct techniques to diagnose skin disease like Malignant melanoma i.e. melanoma skin tumors, Non-melanoma i.e. squamous cell carcinoma (SCC), basal cell carcinoma (BCC), Genetic Diseases i.e. Sickle-Cell Anemia Genetic Skin Disorder, Fungal (infection) Diseases, Bacterial (infection) Diseases, Acne, Psoriasis and Leprosy.

There are different techniques to diagnose these skin diseases. But the most useful and non invasive method for diagnosis of different types of skin diseases is skin impedance measurement. The analysis is made with the measurement of skin impedance over a wide frequency range from 1 kHz to 1MHz.
But this analysis for the infected skin and normal skin should be made at same frequency because at different frequencies skin impedance can be different. The measured skin impedance at same frequency of infected skin and normal skin is different, because of which we can diagnose skin disease. Above mentioned method used the non-invasive probe electrode system consists of two concentric electrodes attached to a ceramic plate. The outermost electrodes drive the voltage and inner is sink electrode gives output. Diameter of the outermost electrode is nearly 10mm.

Measurement of skin impedance can be used for neurological diseases, nerve lesions, depressions and anxiety. It is also used for physiological measurements emotional disorders or lie detection. The various types of bio-impedance method include multiple frequency BIA (MF-BIA), single frequency BIA (SF-BIA) and Bio impedance spectroscopy (BIS). SF-BIA is generally performed at a frequency of 50 kHz. At this frequency the current passes through both extracellular and intracellular fluid. Bio-impedance obtained at more than two frequencies is analyzed in multiple-frequency bio-impedance analysis [1].

II. CLASSIFICATION OF SKIN DISEASES

There is various state-of-the-art skin diseases described in the literature. These are discussed in the following section.

2.1 Malignant melanoma i.e. melanoma skin tumors This is most harmful skin cancer observed in white skin countries. Malignant melanoma is further classified into two type namely basal cell carcinoma (BCC) and squamous cell carcinoma (SCC).

2.1.1 Basal cell carcinoma
This is most common type of skin cancer and nearly 80% skin cancer patients fall under this category. It is slow growing and at least 75% first tumors are observed on face. The diagnosis of this type of skin cancer is performed using techniques like visual inspection of a lesion followed by biopsy and appropriate treatment. Bio-impedance method is one of the methods in detecting this type of skin cancer [2].

2.1.2 Squamous cell carcinoma
In this type of skin cancer lesion is on the head and neck with size less than 5mm. Lesion borders are well defined having superficial growth pattern. Primary lesion of this disease is on hands and feet.
For diagnosis of this disease shave biopsy is appropriate method when lesions are small. Protuberant and punch biopsy are appropriate for lesions having large size. Another method is excision surgery most appropriate for well defined skin cancers as well as for certain benign lesions. The treatment also includes excellent cosmetics and cryotherapy [3].

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(a) (b)

Fig 1: Malignant Melanoma (a) Squamous cell (b) Basal cell carcinoma

2.2 Genetic Diseases

Genetic diseases are basically divided in two types namely Sickle-Cell anaemia and Genetic Skin Disorders.

2.2.1 Sickle-Cell Anaemia

This is common type of skin disease mostly found all around the world. Sickle cell anaemia affects more than 2 million persons worldwide. About 10% population of African descendant in the USA are carriers of this disease. It is human hereditary disease caused by homozygosis of a recessive mutation or deletions in the haemoglobin β chain gene. This disease is not absolutely fatal but crises may occur when the blood vessels are clogged and complications may arise due to poor blood circulation [4]. The diagnosis of this type of skin disease is performed using techniques like therapeutic approach, which involves correction of the defective β-haemoglobin mRNA by the similar (fatal) and normal (anti-sickle) protein transcript using a transpiring ribosome and the generation of a normally functional transpiring.

2.2.2 Genetic Skin Disorders

Genetic skin disorders are associated with significant morbidity and some cause early mortality. For diagnosis of this type of skin disease, diagnose modifying therapies have been lacking, but the rapidly growing understanding of the pathomechanism of many genodermatoses gives tremendous translational therapeutic potential. This disease is normally found in born and up to 1 year baby.

2.3 Leprosy

This is another common type of disease found in undeveloped countries and rural areas. Mycobacterium leprosy is responsible pathogen and produces cutaneous lesions and neurological deficits. Manifestation of this disease depends on immune response to infection, better treatment and management has led to a decrease in disease prevalence. The definitive route of transmission for leprosy is unknown but it is most spread by the respiratory route or through broken skin. Diagnosis technique consists of physical examination of skin smear and skin biopsy. On physical examination lesions should be evaluated for enlargement, tenderness and sensory loss. Another method is biopsy applied on proper lesions can demonstrate extent type of infiltrate and involvement of dermal nerves.

2.4 Viral Infection Diseases

These diseases are observed as viral infections on hand, foot and mouth, scientifically known as Rubella or Human Papillomavirus. These viruses are ubiquitous in nature and self-limiting. As many as 80% of herpes simplex virus (HSV) are infections asymptomatic; although recurrent infection is associated with significant morbidity and particularly in immune compromised. Hand, foot and mouth skin disease occurs normally in the undeveloped countries on an average age of every 3 years or less than 5 years of children being most commonly affected [8]. Viral disease is diagnosed by simple clinical test.

2.5 Bacterial (infection) Diseases

These diseases are uncommon in children relative to adults. Autoimmune diseases are blistering and lead to pain and bad impact on cell functioning, skin become scarring and mucosal ulceration. Accurate diagnosis utilizing histopathology and immune fluorescence studies are required. It is important for determination of prognosis and selection of the most appropriate treatment. Other than in mild infections systemic therapy is usually needed but caution and appropriate monitoring must required.

2.6 Most common diseases

2.6.1 Psoriasis

Psoriasis can affect paediatric patients in three major forms: 1) self-limited infantile 2) early-onset psoriasis and paediatric psoriasis with psoriatic arthritis (PsA). The lesions are of variable size, sharply demarcated, dry and usually covered with layers of fine silvery scales. Skin folds may be predominantly affected. For this disease, treatment options include topical therapy, systemic agents including non biological traditional agents and biologics, UV phototherapy and a combination of these above methods. There are different benefits, risks, and side effects of various therapies. Topical therapy and phototherapy are moderate in severe cases. Non biological systemic therapy and biological systemic therapy is easily diagnosed for early stage disease [7].

2.6.2 Acne

This is common type of disease caused by bacterial infection which limits lesions on face, shoulders, upper chest. Acne is caused by overdose of drugs and found usually on trunk rather than face. Normal visual method is use to diagnose and in rare case biopsy used. Acne normally found in young male and female population.

(a) (b)

Fig.2: Skin diseases (a) Acne (b) Psoriasis

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III. EXPERIMENTAL BLOCK DIAGRAM

Block diagram consists of skin as input connected with two electrode probe. The outer circle denote as source electrode and inner circle denote as sink electrode. Network analyzer used in this work is AD5933. This gives real and imaginary value from that we calculate impedance of skin. Here I2C bus is used to communicate between network analyzer and skin electrode. Microcontroller is used to communicate between Personal Computer and hardware. Personal computer is used to access database and shows graphical user interface. MATLAB is used to calculate impedance from real and imaginary values stored in access database.

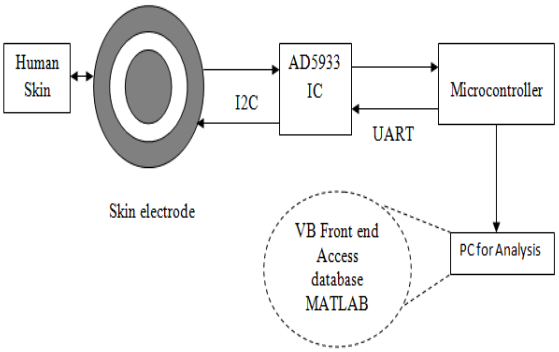

Fig 3: Experimental Block diagram

IV. DISCUSSION

This impedance measurement technique is non invasive and simple method to measure skin impedance and diagnose different skin diseases, skin activity and cell activity. Values of magnitude, real, imaginary and phase indices are generally statistically different over BCC than benign lesions or normal skin. No significant differences are found in real value. Differences may result because BCC tumours may be better irrigated by the local blood supply than normal skin. The nuclei of BCC cells tend to be larger and the intercellular spaces are smaller than normal skin. These structural differences appear to cause measurable differences in the impedance of the tissue as a function of frequency. The state of the art methods are costly, time consuming and require special dermatologist.

V. CONCLUSION

Bio-impedance measurement for analysis of skin diseases is used in diagnosis of early stage skin diseases like Malignant melanoma i.e. melanoma skin tumours Non-melanoma 1) basal cell carcinoma 2) squamous cell carcinoma, skin disease like Sickle-Cell Anaemia, Leprosy, Hand, foot, mouth skin diseases, scabies, Rubella, Acne, Psoriasis. From this technique we control our body parameter and prevent occurrence of different diseases like skin cancer. The main advantages of the bio-impedance method are very low power, low cost and portable.

REFERENCES

[1] B.Taji,S.Shirmohammadi, V. Groza and M.Bolic, "An ECG monitoring system using conductive fabric," in Proceeding IEEE International Symposium Medical Measurements and Applications (MeMeA), May 2013, pp. 309-314.

[2] S.Ahmad,S.Chen, K.Soueidan, I.Batkin, M. Bolic and H. Dajani,"Electrocardiogram assisted blood pressure estimation," IEEE Transaction Biomedical Engineering , vol. 59, no. 3, pp. 608-618, Mar. 2012.

[3] Mas S. Mohktar ,Sami F. Khalil and Fatimah Ibrahim,"The theory and fundamentals of bioimpedance analysis in clinical status monitoring and diagnosis of diseases," Molecular Diversity Preservation International Open Access Journals, pp. 10895-10928, 2014.

[4] D.G.Beetner,S.Kapoor,Manjunath S.,X. Zhou, and W.Stoecker, "Differentiation among basal cell carcinoma, benign Lesions, and normal skin using electrical impedance," IEEE Transaction Biomedical Engineering , vol. 50, pp. 1020-1025,Aug. 2003.

[5] H. P.Schwan, Electrical properties of tissue and cell suspensions. Advanced Biological Medical Physics,5

[6] Goksun Ayvaz and Ali Riza Cimen. Methods for body composition analysis in adults. The Open Obesity Journal, (3):62-69, December 2011.

[7] M. Siervo and S. Jeeb.,"Body composition assesment theory and practice." IEEE Engineering in Medicine and Biology Magzine, pp. 48-57, January/February 2010.

[8] S.Kapoor, "Bioelectrical Impedance Techniques for clinical Detection of Skin Cancer," M.S. thesis, University Missouri, Rolla, 2001.