Skin cancer, as classified on the Skin Cancer Foundation website, is the most common type of cancer in America, but a specific form called melanoma holds the title for causing the highest number of deaths by skin cancer. It is caused by a disruption in melanin production when a person is exposed to ultraviolet radiation from the sun or tanning lamps. This develops when the skin cells are damaged via radiation resulting in unrepairable DNA that triggers mutations to form the cancer. If the melanoma is found early enough, it is easily curable through an incision of the affected section of the skin. Although, if it is discovered too late, fatality is highly inevitable. The only effective way of diagnosing melanoma is through a biopsy, a medical test that involves sampling of cells or tissues for examination. Biopsies are a burden for the patients because not only does the procedure leave a permanent scar, but it is also extremely expensive. Sometimes biopsies may also be inconvenient for doctors if the results are negative for melanoma [1].

When a patient walks into a dermatologist’s office concerned about a mole, the doctor first visually examines the lesion, using the alphabet (ABCDE) guidelines – asymmetry, border irregularity, color variation, diameter, and evolution, as stated in MayoClinic.org. The dermatologist can tell just by looking at the mole if it is non-invasive, but if the mole fits those guidelines and raises suspicion, the doctor then uses devices that help him or her determine if the patient should have a biopsy [2].

Body imaging, according to Dermatology News, a technological procedure in which images of the skin are systematically detected to detect growth patterns in the skin lesion, may possibly reduce melanoma biopsies. By examining the skin through body imaging, dermatologists can determine the severity of the lesion’s abnormality with more accuracy than by just physically looking at the patient’s moles [3]. An example of a technology derived from body imaging is Melafind. As an imaging device described in the Dermatology Times, Melafind uses dermoscopy along with systematic algorithms to magnify an image off the lesion and display useful information for the doctor to determine if a biopsy is necessary. Because the technology behind Melafind was originally used for missile navigation by the Department of Defense, its under-the-skin scanning process is more effective compared to a different technology involving body imaging, thus leading to more precise outcomes [4].

According to an article in The New York Times, it is a global agreement that melanoma’s increasing incidence rate is an urgent issue in America, but opinions vary on how the problem should be approached. Some may argue that if more people were to get annual screenings, as dermatologists recommend, that less would die from melanoma. On the other hand, others argue that the solution to this public problem is more advanced technology that better addresses the cancer [5]. In my opinion, technologies such as Melafind are the future for a healthier tomorrow. It is a more accurate, economical, and convenient, way of diagnosing melanoma than automatically calling for a biopsy without further examination.

Due to modern society’s obsession with glowing tan skin, more and more people sunbathe in unhealthy amounts, leading to higher risks of developing skin cancer. Melanoma calls for a major concern in America because it causes nearly 10,130 deaths each year, resulting in three-fourths of skin cancer-related deaths, as mentioned in an article in Dermatology News [3]. This issue should also catch the attention of engineers, specifically biomedical engineers, who concentrate on ways of solving medical problems by designing and improving medical devices. An engineer’s job is to approach problems and come up with efficient and economical ways of resolving those problems through devices like Melafind, therefore the issue of increasing melanoma deaths serve as an ideal problem for engineers. Since I am pursuing bioengineering and have a general interest in helping improve society, this topic is significant to me as well. Additionally, I have been personally affected by melanoma, since my great-uncle passed away from this deadly disease.

Disclaimer—This paper partially fulfills a writing requirement for first year (freshman) engineering students at the University of Pittsburgh Swanson School of Engineering. This paper is a student, not a professional, paper. This paper is based on publicly available information and may not provide complete analyses of all relevant data. If this paper is used for any purpose other than these authors’ partial fulfillment of a writing requirement for first year (freshman) engineering students at the University of Pittsburgh Swanson School of Engineering, the user does so at his or her own risk.
A BETTER LOOK AT THE SKIN: TECHNOLOGIES THAT DECIDE THE NEED FOR A BIOPSY

In body imaging, an imaging software detects lesion changes over a period. If in fact there are changes in the skin, the dermatologist will use the variations to determine the severity of the skin’s abnormality. If the results are drastic enough to cause suspicion, as seen on the Rachel Ray Show, the doctor will call for a biopsy to get a proper melanoma diagnosis. Most of the time, dermoscopy is used along with imaging. Dermoscopy is an examination of the skin using magnification devices with light-emitting diode (LED) lights which highlight melanoma-related aspects on the lesion [6]. Because the naked eye is limited to seeing small things, dermoscopes go a long way in examining suspicious moles. In fact, praised dermatologist Doctor Dorris Day, from Day Dermatology and Aesthetics in New York City states, “It helps me see what I cannot see with my naked eye. Melafind gives me great comfort that I am not missing a melanoma” [5].

Melafind: Cutting Melanoma Biopsies One Scan at A Time

A form of dermoscopy is found in a relatively new medical device called Melafind. Melafind, as defined on the product’s own website, is a handheld imaging device that is driven by a software that analyzes data to help dermatologists evaluate a possible melanoma lesions up to 2.5 mm deep beneath the skin. By analyzing the findings of the images, the software classifies the degree of disorganization of the mole’s structure. The mole’s disorganization is related to the level of its irregular growth pattern. Also, if Melafind is used on a patient with multiple moles, the program ranks each mole by severity, therefore notifying the dermatologist of which lesions to prioritize. This is what makes Melafind such a ground-breaking innovation – it gives physicians numerical data that helps determine the risk of melanoma on a lesion, asides from just showing enlarged pictures of it.

Along with being approved by the Food and Drug Administration (FDA) in 2011, Melafind was found to have a 98.3% sensitivity towards the deadliest skin cancer. In a study, hundreds of abnormal lesions were tested and Melafind correctly detected 173 out of 175 of the moles as malignant [7]. This was so impressive to Doctor Hensin Tsao from General Hospital in Boston that he exclaimed, “Until now, patients trusted only the doctor’s discretion, but now with this new device, we have a three-way interaction (Melafind, doctor’s decision, and X-rays) for determining melanoma. It’s a brand new paradigm” [5]!

As listed by MELA Sciences, the company that owns Melafind, this diagnostic tool comes with many benefits for both the patient and the physician, asides from its accuracy.

For instance, scanning the patient’s lesion only takes less than a minute, whereas a biopsy must be scheduled at a different time and could last up to a fifteen-minute procedure. Within those sixty seconds, the handgun scans with near-infrared light waves, the software detects patterns on the mole, and then it spits out extremely useful results. The technology displays data and images on a monitor, making it easy for the doctor to make a quick decision for biopsy and giving the patient the opportunity to also see the results. If a patient were to get a biopsy, it could take up to three to seven days to get results back. Additionally, Melafind’s speedy procedure does not cause any pain nor scarring, unlike how a biopsy would [8].

The Only Gun That Could Save You Thousands of Dollars

Before Melafind, if doctors had even a small degree of suspicion towards a lesion, the automatic protocol was to call for a biopsy, which are costly. Ranked as one of the top five medical technology innovations in ASME.org, Melafind is a convenience in terms of decreasing unnecessary procedures along with cutting medical expenses of the patients. It can cost a patient anywhere from $25 to $150 for the Melafind procedure, compared to hundreds or even thousands of dollars for a biopsy [9]. Although in some instances, Melafind may cause unnecessary procedures. An article in The New York Times pertaining to professional opinions on this device explained that biostasticians worry about the fact that Melafind’s high rate of melanoma detection may lead to possible false-positive scores, thus misleading dermatologists to call for biopsies. On the other hand, it is better to wrongfully diagnose melanoma is than to wrongfully misdiagnose it [5].

*KNOCK KNOCK!* WHO’S THERE? MELANOMA!

Melanoma, America’s most notorious murderer in terms of cancer-related deaths, is ironically easily curable. Its incidence rate in the United States has doubled within the past thirty years from 37,536 cases in 1973 to an estimated 76,380 cases in 2016. According to SkinCancer.org, one in every fifty-two Americans will be diagnosed with this invasive skin cancer. With today’s advanced medical technologies, doctors and engineers have come up with techniques, medicines, and conclusions that led to the decrease in most cancer cases and deaths, although melanoma does not fit that trend. The issue with this is the high number of misdiagnoses due to people’s neglect towards dermatologists’ recommendation of getting annual skin screenings as well as the lack of proper technology that address this cancer. Furthermore, the only way to undeniably diagnose a patient is through a skin biopsy [1]. This can be an inconvenient process for those who get the
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procedure done just to find out that their skin abnormality is not malignant, especially since it comes with a large price.

You Can’t MelaFIND a Better Diagnostic Product Than This

A solution to the complications of this limited diagnostic technique for melanoma is innovative technologies that help the diagnostic process of the cancer while cutting down the price of doing so. Melafind, an imaging and data analysis device that uses ten near-infrared light waves, is designed to examine abnormal skin lesions non-invasively and provide dermatologists with additional information to help them make a decision to biopsy the mole. As written Melafind.org, because of its high accuracy, this device has made a landmark in aiding doctors’ discretion on melanoma diagnosis, along with creating an improved diagnostic process in terms of efficiency, accuracy, and cost, compared to orthodox techniques [7].

Attention Bioengineers!

As a future biomedical engineer, I aspire to design something like Melafind because lower costs and higher efficiencies are what engineers aim for. The high death rate caused by melanoma should concern engineers because it is a crucial problem in America and as professional problem-solvers, it is an engineer’s duty to improve this issue. Whether it be through a family member, friend, or even themselves, everyone in this society has been affected by cancer, hence America as a whole should be concerned with one of the deadliest cancers. The topic of melanoma and its increasing rate of incidence is significant to me, in that my great-uncle had passed away from it. He had multiple questionable moles all over his body and after visiting the dermatologist, one of the fives moles were found to be malignant. Right away, he had gotten it removed and our whole family was relieved that the cancer was discovered early enough to remove. A few months after the procedure, he died from a misdiagnosed melanoma – one of the other four lesions he had was in fact cancerous, but the dermatologist did not have technology advanced enough at the time to help discover the severity of the other mole. If the dermatologist had used Melafind, it is very likely that it would’ve detected the lesion’s degree of disorganization to lead the doctor to biopsy it. If Melafind had been a product when my great-uncle was alive, he might still be with us today.

SOURCES


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