

## IMAGE GUIDANCE IN THE HAIR RESTORATION PROCESS: AN EVOLUTION IN SAFETY

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From the standpoint of studying hair loss or androgenetic alopecia with non-invasive imaging, there appears a sensible solution to support both the management and research in a growing number of pharmaceutical and cosmetic treatments of this condition. The sonographic pre-depiction of the presence of remaining hair follicles in the dermis within epidermal dysfunction may suggest the optimal type of medical treatment (or surgical treatment). If we start with a basic premise of an area of the scalp with no hair follicles at all, current data may suggest that surgical or transplant treatment is the only option available.



The diagnostic use of ultrasound or high resolution sonography for hair restoration procedures has been validated with electron microscopy in various key studies. Imaging innovations allow dermatologists and hair transplant specialists to identify follicles in their biologically active present condition. Imaging advancements help to define follicles as either dormant/inactive, intermediary or active & healthy growing. Follicles in that inactive or dormant stage may suggest a decrease in follicular health, usually suggesting a delay surgical procedures and instead application of more topical or interventional treatment options into that area to boost the production of scalp health and cellular regeneration. In the case of normal & healthy hair; this is ideal to proceed with ultrasound guided transplant treatment.

### LAND MINES vs. IMAGE GUIDANCE

Hair transplants are considered minimally invasive procedures which often includes bleeding (due to its

engagement with large blood vessels or aberrant arteries). Because of this, potential risks may include tapping into unsuspected skin conditions like cancers nearby or underneath- often identified with the use of clinical imaging. The term “scan and treat” is a research term that may also apply to clinical procedures. In the case of IMAGE GUIDANCE, the inclusion of real-time ultrasound monitoring adds a significant layer of safety and added confidence in the technician’s role-- forging a more expedient treatment pace from potential surprises.

During the implant process, there may exist certain LAND MINES like a subcutaneous tumor or a cluster of dilated vessels called a hemangioma that can bleed profusely. Occasionally there may also exist nerves that are traversing the base of the neck or shoulders that may accidentally be damaged in a postoperative situation. Since the micro vessels in the scalp bleed profusely, the formation of a blood clot or hematoma or inflammatory process can also be imaged.

Today, we have the availability to use adjunct ultrasound features such as elastography, which shows scarring in the skin. In other words, scar tissue is hard and it may be more difficult to put a probe through heavily scarred tissue. Oftentimes areas that scar have micro or macro calcification – aptly called “an



iceberg” of calcium or a bone underneath the area where the technician may be injecting or inserting stillets.

Additionally, inflammatory disorders like skin cancers may reside under the scalp. Use of a thermogram is also available to detect subdermal anomalies. Finding a mass or a fluid collection is of concern. Fluid is avascular (no blood vessels) which means no heat. A big fluid spot will show up dark on our imaging with low temperature. Inflammation will appear as a brighter hot spot because it's full of inflammatory vessels. This procedure is used internationally to locate areas of wound healing. When a wound is healing correctly, there's very low temperature, what we might consider normal healing temperature. When an area is inflamed or is infected, the temperature in that given area is elevated and the thermogram represents this temperature increase as a bright spot correlating with the degree of inflammation.

### SCANNING PROCESS & PATHOLOGY

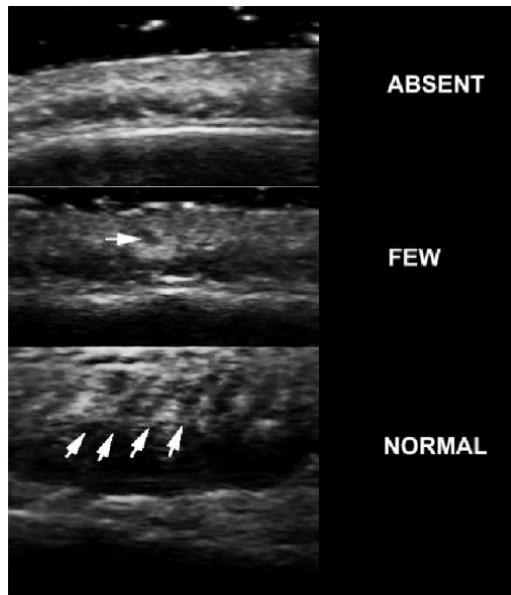
Once we have the top half of the skin (the dermis) covered optically or photographically, we may then apply high resolution ultrasound which starts from the epidermis and goes down to hit the bone. Instead of 200 micron depth, you have a hundred times greater penetration, around 2-20 centimeters of depth depending on the ultrasound transducer (or probe). The ultrasound is adjustable for targeting the exact site, depth wise.

Today’s ultrasound probe designs are actually quite ideal for hair transplant process. There are a variety of probes (curve, flat, square, linear etc) that are designed for a wide range of unique applications. Similar to ultrasound guided biopsies, integrating an ultrasound probe with an active transplant needle can call for PRO GUIDES where you can attach the device either to inject or to extract to the guide more accurately. Having a live subdermal monitor available to you allows for an added level of safety as far as what NOT to target. If there's a nerve that



you're about to hit or a large vein, or (hopefully not) a larger sized artery, you can avoid it as you're doing it. So forewarned is forearmed in this case.

Diagnostically speaking, this imaging application can be used to uncover problems that cause the hair loss before it actually happens. There are many cases where someone with a full head of hair can have inflamed follicles. You cannot see this with the naked eye even with magnification tools - but is easily identified with ultrasound imaging in the mid part of the dermis and lower part of the dermis (where the follicles arise from). This inflammation offers a prediction of upcoming hair loss if unmitigated. It is from this imaging test that we are able to caution the patient about an underlying disorder. Upon further subclinical inquiry and investigation, we find such disorders to stem from hereditary baldness due to (possible) inflammatory skin disease such as rosacea or psoriasis.



Additionally, autoimmune diseases such as lupus and sometimes certain cancers cannot be seen from the skin- even though they may manifest eventually in hair loss. Early indicators can be itching or redness, which in itself is a cause of scalp loss and great distraction to everyday normal functioning. Further investigation of this inflammation through clinical imaging may easily show the disease, how deep the inflammatory disease is- and then how aggressive it is.

Recognizing the condition shows that abnormal skin appears white and inflamed- whereby normal dermis is dark.

Appearance of a whitish layer to a grayer and sometimes a darker level identifies the degree of inflammation. Then, we also look at the blood flow (which the 3D Doppler function provides) whereby the more inflammatory blood flow in the area, the more aggressive the disease may be. This is the activity visible BELOW the skin. It may show up as a little redness on top, but the “real drama” occurs below the skin, which is why it's often missed clinically. For this reason alone, use of clinical imaging such as ultrasound technology and other optical technologies are extremely important to see what is missed by the naked eye.

## ABOUT THE AUTHOR



ROBERT L. BARD, MD is internationally recognized in the field of 3D DOPPLER ULTRASOUND IMAGING to detect cancers (in organs including the breast, prostate, skin, thyroid, melanoma and other areas). As a certified diagnostic radiologist, Dr. Bard evolved his practice to pursue non-invasive 3D imaging with ultrasound, MRI and laser technologies. He is also passionate about conducting educational presentations and publishing in International Medical Journals. Dr. Bard currently holds various medical licenses (in NY, NJ, CT and FLa) and holds Board certification from the American Board of Radiology (1974) and Fellowship in the American Society of Lasers in Medicine and Surgery (2014).<https://drrobertbard.com/>

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