Researchers demonstrate technique to give us better understanding of human tissues

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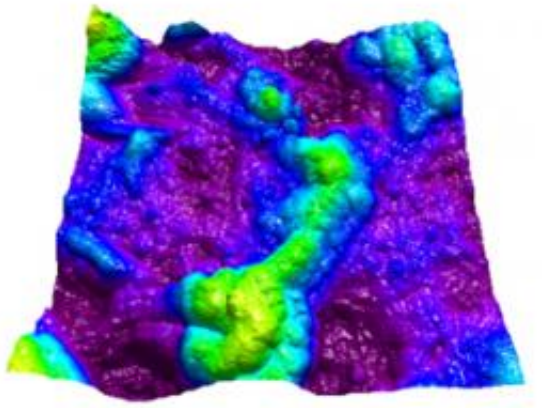

High resolution atomic force microscopy image of inner limiting membrane extracted from a human eye.

(Medical Xpress) -- Research from North Carolina State University demonstrates that a relatively new microscopy technique can be used to improve our understanding of human tissues and other biomedical materials. The study focused specifically on eye tissues, which are damaged by scarring in diabetic patients.

“Our findings are a proof of concept, showing that this technique is extremely effective at giving us the data we need on these tissues,” says Dr. Albena Ivanisevic, co-author of a paper describing the research. “Specifically, it gives a great deal of information on the composition of

these tissues, as well as the tissue's topography, or surface characteristics." Ivanisevic is an associate professor of materials science and engineering at NC State and associate professor of the joint biomedical engineering program at NC State and the University of North Carolina at Chapel Hill.

The study is one of the first to explore how this technology, called bimodal dual AC mode microscopy, can improve our understanding of human tissues and biomaterials.

The research team, which included researchers from Purdue University and the University of Louisville School of Medicine, examined two types of eye tissue from diabetic patients. Specifically, they looked at the inner limiting membrane (ILM), which is the surface layer of the retina, and so-called epiretinal membranes. Epiretinal membranes are scar tissues that form on the ILM in diabetics. Scar tissue can cause significant damage to the retina and, if untreated, may lead to blindness.

There are multiple treatments for this scarring. In the United States, a common technique is for a surgeon to peel off the ILM, removing the scar tissue with it. In many other parts of the world, surgeons inject dye into the eye to better distinguish the parts of the eye they will operate on. This process is not currently allowed in the United States, due to concerns about the dye's toxicity.

The researchers launched this project, in part, to determine if bimodal dual AC mode microscopy could be used to provide a better understanding of the topographical properties of the ILM. Further, the researchers wanted to use the technology to see if it offered insight into how – or whether – various dyes affect the topographical characteristics of the ILM. "All of this information could be used to improve surgical outcomes and to foster research into additional treatments for the condition," Ivanisevic says.

The researchers found that bimodal dual AC mode microscopy, an atomic force imaging technique, captured the properties of the tissue in exceptional detail. Atomic force imaging effectively runs a probe over the surface of a material to collect data on its topography, similar to the way in which a record player's needle runs over the surface of an album.

"The next step would be to use this technology to assess the utility – and potential risk – of various dyes," Ivanisevic says. "If we can find a dye that is extremely effective and poses little risk, it may be approved for use in future surgeries."

The paper, "Deposition of Triamcinolone Acetonide and Its Effect on Soft Tissue Topography," was published online June 5 in Advanced Healthcare Materials. Lead author of the paper is Celimar Valentin-Rodriguez, a Ph.D. student at Purdue. Co-authors are Ivanisevic and Dr. Tongalp Tezel, of Louisville. The research was supported by a George Washington Carver Fellowship and Research To Prevent Blindness Inc.

More information: The paper, "Deposition of Triamcinolone Acetonide and Its Effect on Soft Tissue Topography," was published online June 5 in *Advanced Healthcare Materials*. Lead author of the paper is Celimar Valentin-Rodriguez, et al, of Louisville. The research was supported by a George Washington Carver Fellowship and Research To Prevent Blindness Inc.

Abstract
Bimodal imaging is utilized to characterize the topography of human tissue samples. The deposition of Triamcinolone Acetonide (TA) on various surfaces including –surgical human inner limiting membrane (ILM) samples and collagen fibrillar sheets- was studied. Changes in composition were well defined with bimodal imaging when TA deposition was examined on mica. TA sedimentation resulted in observable changes in ILM topography when compared to collagen

fibrillar sheets. The heterogeneous chemical and topographical features of the ILM tissues promoted the TA crystallization compared to the flatter and homogeneous collagen surfaces. Higher spatial resolution was achieved by imaging ILM samples in the new bimodal imaging mode. The most apparent difference was observed in the imaging of ILM samples which had been exposed to the steroid TA. The study demonstrated the usefulness of bimodal imaging to evaluate tissue samples.

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