stroke and cancer. This approach can also be applied for depth-resolved oxygenation imaging in multi-layered tissues including retina, skin and other epithelial tissues. Resolution of depth-resolved SaO_2 measurements that DWP-OCT is capable of providing in multi-layered tissues requires further investigation and will be reported in the future. Proof-of-concept experiments reported here using DWP-OCT for *in vivo* measurement of SaO_2 did not employ a scanning system and were limited to point measurements at selected tissue depths. Incorporation of a two- and three-dimensional scanning system will facilitate anatomical identification of tissue microvasculature for blood oxygenation measurements. In summary, we have reported for the first time a DWP-OCT method to probe depth-resolved SaO_2 levels in microvasculature *in vivo* in selected murine brain arterioles.

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