Determination of laser transmittance through various thicknesses of SutureSeal

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Objective:

To determine whether near infrared laser therapy is effective when applied through SutureSeal.

Background:

Various bandage materials have been developed for veterinary purposes. The question often arises whether a practitioner can apply laser light effectively through the bandage. A Companion Animal Health webpage warns against using lasers through any kind of bandage or skin covering [1]. At the other extreme, the Erchonia Laser company claims to be able to treat humans through their clothing [2].

Several controlled, peer reviewed studies have been carried out to test specific wound dressings in combination with laser therapy. Martins *et al*. investigated treatment with hydrocolloid occlusive dressing on rat wounds.[3] The material was described as "the hydrocolloid occlusive dressing used was composed of carboxymethylcellulose absorbent particles, encapsulated in an elastic and adhesive synthetic dough of polyurethane, flexible, permeable to oxygen and moisture vapor." [3] The study found accelerated wound healing with combined 660 nm laser treatment and hydrocolloid dressing. The transmittance of laser light was not reported.

Wachal *et al* applied laser therapy through HydroAid hydrogel material on a human forearm. [4] The dressing transmitted 92% and 98% of 660 nm and 800 nm laser light respectively. The hydrogel maintained a skin temperature below ambient although it became thinner and less flexible within 6 hours after exposure to light.

The purpose of this study was to investigate the transparency of SutureSeal to red and near infrared laser light.

Procedure:

The initial study involved application of SutureSeal material to glass slides in various thicknesses from 0.033 cm to 0.22 cm. A Class IV K-Laser Platinum Series P4 Therapy Laser was applied in 636 nm, 803 nm, 911 nm and 971 nm wavelengths. The glass slide covered a 1-cm diameter port of an integrating sphere (an instrument that collects all of the light which penetrates a scattering material). The light was detected with a StellarNet spectrometer and associated SpectraWiz software as shown below. The transmitted light was divided by the light collected with no sample in place.

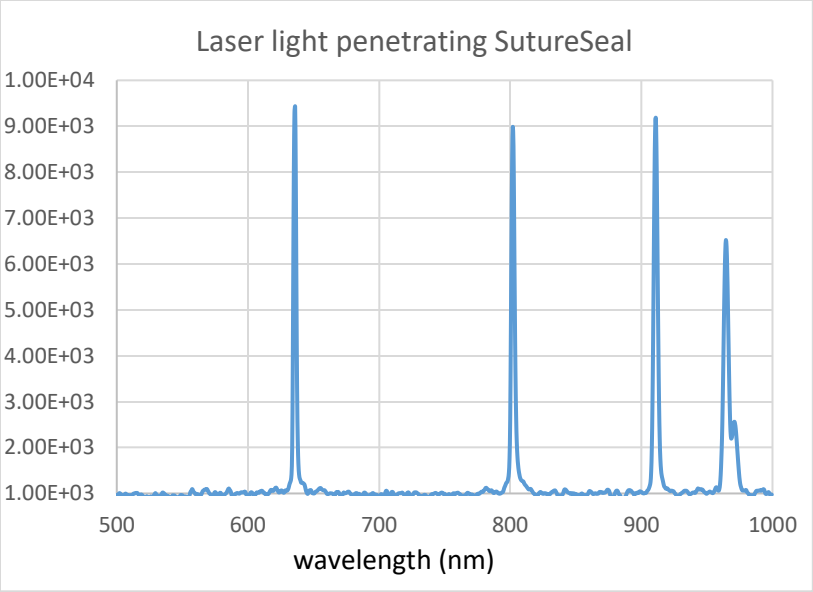

Figure 1. All four wavelengths are displayed at once. If desired, a single wavelength at a time may be selected.

Results:

The table below gives preliminary results for the average penetration of red (636 nm) and near infrared laser light through various thicknesses of SutureSeal on glass slides. N = 4 per wavelength. Transmittance is affected by both absorption and scattering of light, which is wavelength dependent.

Wavelength	**.033 cm % T**	**0.054 cm % T**	**0.067 cm % T**	**0.22 cm % T**
636 nm	99+/- 5	86+/- 5	94+/-3	96+/-3
803 nm	97+/-4	80+/-5	87+/-2	94+/-1
911 nm	90+/-6	71+/-4	83+/-4	87+/-12
971 nm	72+/-14	91+/-3	81+/-4	92+/-12

Table 1. Percent of incident light that penetrates the SutureSeal material on a glass slide.

Discussion:

The data supports the idea of using red and near infrared laser therapy with SutureSeal in place. One could divide the prescribed laser treatment time by the fractional transmittance to adjust the time of laser application while keeping the prescribed power constant. These experiments will be repeated and additional thicknesses will be included to ensure statistically reliable results. Future plans also include investigation of beam spread and temperature during the laser treatment.

References:

[1] http://www.litecure.com/companion/2015/03/the-naked-truth-why-laser-therapy-shouldnt-be-applied-through-bandages-or-casts/

[2] https://www.wellspringhopkins.com/cold-laser-therapy/

[3] Martins SS et al. Analysis of the healing process of the wounds occurring in rats using lasertherapy in association with hydrocolloid *Acta Cirúrgica Brasileira* - Vol. 30 (10) 2015 - 681

[4] Wachal K et al. Physical properties of hydrogel wound dressing and its use in low-level laser therapy (LLLT) Lasers Med Sci (2018) 33:1317–1325

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