

## Graphical Study of Absorption Ratio of Chromophores as a Function of Wavelength

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### Abstract

We studied the selective photo-thermolysis induced by diode laser.<sup>1</sup> It is found that about 5 to 6 or more sessions are essential for reducing the number of hairs from different parts of the human body. Melanin is the prominent chromophore present in the hairs. Oxy-hemoglobin is the competent chromophore, with respect to melanin. Ruby laser is obvious choice at these wavelengths but due to its epidermal - melanin interference, it is not suited for removing Indian hairs. Nd:YAG laser also can be used for hair removal but for the Indian skin type IV to VI is it not suited properly. Alexandrite laser is another laser used for hair removal but its side effects are slightly more than the pulsed diode laser. We used 800 nm commercially available pulsed light sheer diode laser as we had to study its applications for hair reduction on Indian patients.<sup>2</sup> There is no indigenously developed laser presently available in the market for Indian skin or hair type.

**KEYWORD :** photo-thermolysis, Oxy-hemoglobin, chromophore,

### Introduction

The fluence used for the laser hair removal depends upon factors like skin type, density of hairs, age of patient, type of hairs etc. It is better to perform laser hair removal treatment in the younger age, when the hair follicles contain more melanin and hair reduction gives 100% efficient results. (Fig. 1) In older age percentage of melanin decreases, hair bulb becomes thinner containing less melanin and laser energy is not absorbed by poor melanin hair bulb.

### Methods

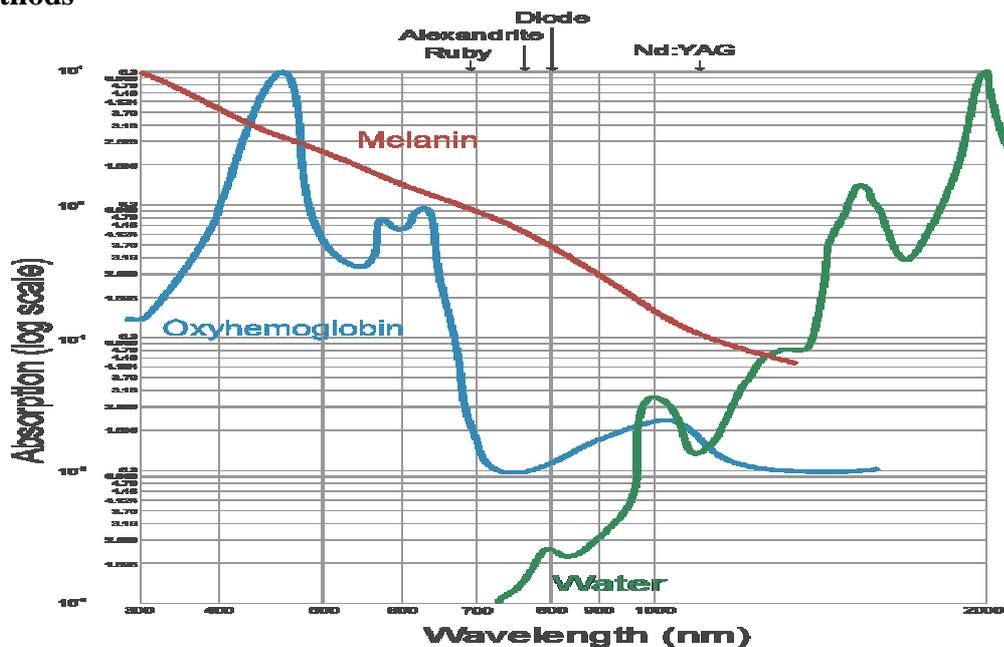
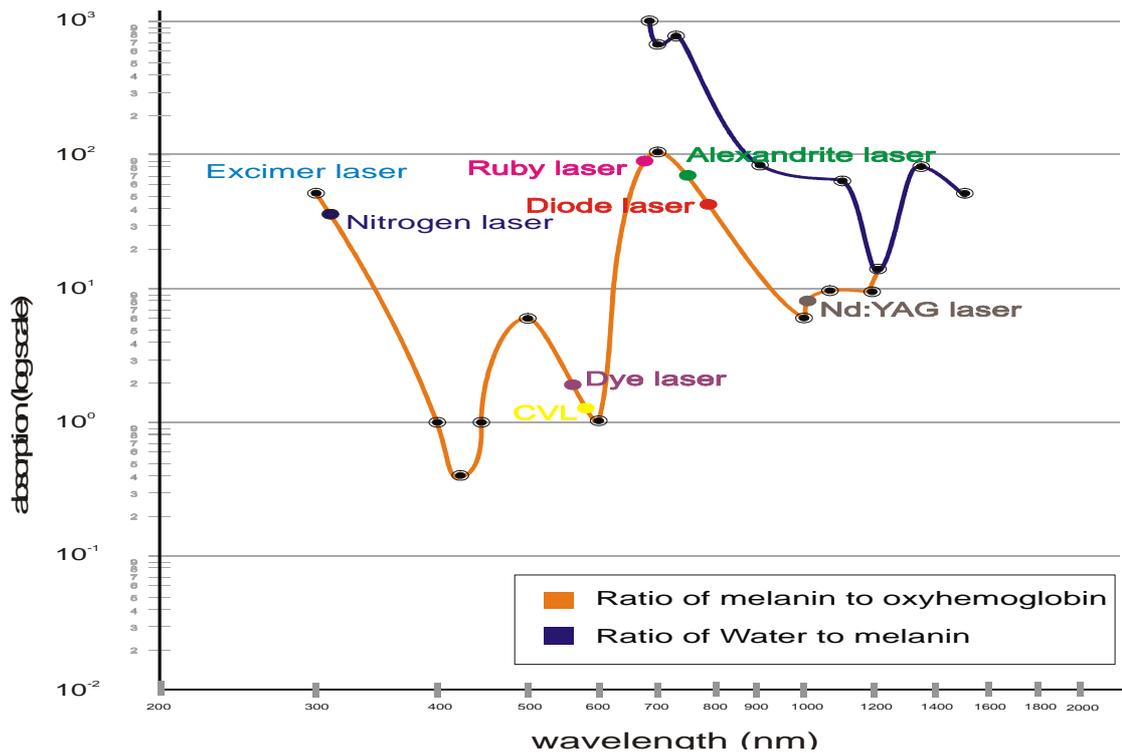


Fig. 1 The absorption of various chromophores as a function of wavelength<sup>3</sup>



**Fig. 2 Graphical study of absorption ratio of chromophores as a function of wavelength<sup>3,4</sup>**

From figure 2 the ratio of absorption between melanin and a chromophore like oxyhemoglobin is maximum i.e. 109 at 700nm.

At the wavelength of ruby (694 nm) the ratio is 104. At 800 nm i.e. a, diode laser wavelength the ratio is 43, also at 308 nm excimer laser wavelength, the ratio is 43. At the wavelength of Alexandrite laser the ratio comes out to be 80. At the wavelengths of dye laser, CVL, Hc-Ne laser, the ratio of melanin to hemoglobin is less and these lasers cannot be used for hair removal. At Nd:YAG laser the ratio is 7.8. The efficiency of this laser is less and the laser may not give the desired results. At the pulsed UV nitrogen laser i.e. at 337.1 nm wavelength the ratio between melanin absorption to oxy-hemoglobin is 15 and can be used as a reference wavelength and all the lasers having ratio greater than 15 can be used effectively for hair removal. Thus the lasers like ruby, alexandrite, pulsed diode laser, excimer and nitrogen laser can be used for hair removal.<sup>5,6</sup>

Traditional hair removal methods have fallen behind with the use of laser or light based technology in the treatment of unwanted hairs due to their high efficacy, low side effects and less post treatment complications, faster results and most importantly better patient compliance. Laser hair removal has currently become very popular amongst patients, aestheticians and dermatologists. It is the best amongst all the available modalities for permanent hair reduction. However there is still a need to achieve permanent and complete hair removal for all skin and hair types. The photopilation technology is progressing rapidly with continued understanding of hair biology, laser physics, skin optics and cooling mechanism and soon it will be possible to achieve permanent hair removal in all skin and hair types.<sup>7,8</sup>

## Result and Discussion

If the pulse width of the diode laser is reduced further, the effectiveness of the hair removal may be improved. If the hair detector is used along with the control system then the hairs may be reduced in one or two sessions.<sup>9, 10, 11</sup> In near future it may be possible to treat all type of Indian hairs with low cost laser (like a nitrogen laser) with reduced number of treatments with Indian made laser for Indian people.

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