USES OF KRYPTON LASER

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There are many Laser Sources and in ophthalmology the range offered has become wider in recent years. The original Xenon as a photo coagulation source is still useful but the Ruby Laser placed into commercial use in 1963 has since been replaced by the Argon Laser in 1968. The Krypton Laser is a most recent addition together with the neodymium Yag Laser.

THE ARGON LASER: 488.0 Nanometer and 514.5 nm.

Advantages:

1. Highly absorbed by haemoglobin and melanin.
2. Extremely large coagulation range possible.
3. Large range of exposures available.
4. High power density available.
5. Neglible ocular media absorption.
6. Excellent delivery system.

Well absorbed by oxyhaemoglobin and reduced haemoglobin and melanin — it is very good for vascular abnormalities and structural problems of the choroid and retina. Variability of power density and spot size and the excellence of the delivery systems makes the Argon Laser the prime photocoagulation system for both anterior and posterior segment defects.

Disadvantages:

1. Diffuse haemorrhagic retinopathies (central retinal vein occlusion, branch retinal vein occlusion, etc.)
2. Foveolar coagulation difficult due to xanthophyll.
3. Penetration of abnormalities may be minimal (capping).
4. Scattered by media — higher power levels at cornea necessary.
5. More destruction of inner retinal layers.

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The Argon Laser can not be used effectively with extreme haemorrhagic retinopathies especially with superficial retinal haemorrhage due to the heat produced and the potential damage to the nerve fibre layer.

Foveolar coagulations at pigment epithelium level are difficult due to high absorption of the blue component (488.0nm) by the xanthophyll pigment in the area of retina.

The green argon (514 nm) is advantageous and the krypton laser more so in coagulation of sub-pigment epithelial neo vascularization in the foveolar region.

KRYPTON LASER (RED)

Advantages

1. Para-foveolar avascular zone coagulation excellent.
2. PRP with haemorrhagic retinopathy (central retinal vein occlusion, branch retinal vein occlusion, diabetes).
3. Production of adhesive chorio-retinitis with structural defects.
4. Sub-pigment epithelial neo-vascularization therapy.

The red 647.1 krypton beam can be used advantageously for pan retinal photo coagulation when confronted with extensive retinal haemorrhages secondary to diabetic retinopathy, central retinal vein occlusion, branch retinal vein occlusion. The red krypton beam is excellent in the foveolar region (as well as the yellow krypton 568.2 nm.) for the photo coagulation and obliteration of sub-pigment epithelial neo-vascularization due to minimal absorption by xanthophyll pigment. Structural defects (tears, etc.) can be treated effectively.

Disadvantages:

1. Inadequate absorption for focal retino-vitreal neovascularization coagulation.
2. Possible power density inadequacy.
3. Limited retinal layer application.

Photo coagulation of surface neo-vascularization and other retinal vascular anomalies is difficult.

Treatment Comparison

		Argon coagulation (488.0 nm)	Krypton coagulation (647 nm)
1.	Inner Retinal Vascular Disorders	4+	0 — 1+
2.	Outer Retinal Vascular Disorders	4+	2 — 3+
3.	Inner Retinal Structural Disorders	1+	1+
4.	Outer Retinal Structural Disorders	2 — 3+	4+

Advantages of Krypton (Red)

1. Retinal haemorrhageic diseases (PRP Treatment):

   Central Retinal Vein Occlusion
   Branch Retinal Vein Occlusion
   Haemorrhagic Diabetic Retinopathy
   Hypertensive Retinopathy

2. Retinal Oedematous disorders:

   Diabetic Maculopathy
   Central Serous Retinopathy

3. Degenerative disorders of choroid and retina:

   Retinal Tears
   Peripheral retinal degeration.
   Pigment epithelial abnormalities especially centrally, less deflection, less absorption by luteal pigment.
   SEMD and disciform degeneration — less deflection.

4. Vitreous opacification:

   Diffuse vitreous haemorrhage or veils, less scatter, less absorption

5. Corneal or lenticular haze: less scatter, less absorption.

	ARGON	KRYPTON
WAVELENGTH	488.0 — 514.5nm	647nm (568 — yellow krypton)
POWER/	> 3W	< 1.5W
SIZE	50 — 2000mic	50 — 2000mic
EXPOSURE	0.02sec. to continuous	0.02sec. to continuous

In the treatment of foveal para-foveal lesions eg. disciform degeneration sub-pigment epithelia neovascularization, etc. — poor results of argon can be attributed to inner retinal absorption (70%) of energy with the area of luteal (xanthophyll) pigment with consequent photocoagulation of the inner retina — manifested clinically by the appearance of a dense white inner retinal lesions with poor visual outcome, because of foveal denervation and late inner retinal fibrosis less energy is available at the level of the pigment epithelium because of attenuation by luteal pigment.

Outside the macula region (which contains luteal pigment) there is focal damage to the pigment epithelium and receptors. Near the foveolar there are 2 sites of distinct coaxial damage. Inner retina demonstrates marked disruption centred not only in the inner nuclear layer but also the plexiform and ganglion cell layers. The lesion in the pigment epithelium is less marked in this foveolar than outside the macular area (equivalent power application).

Argon Laser is also absorbed by Haemoglobin and clinically photo coagulation of a retinal blood vessel produces narrowing and occasional closure of the vessel (vascular occlusion) and this leads to poor functional result due to retinal ischemia. In addition retinal haemorrhages occur and damage ganglion cell axons. Thirdly there is attenuation of the incident radiation with less uptake by the pigment epithelium.

Theoretically it can be predicted that very little krypton laser energy at 647nm. would be absorbed by luteal pigment or by haemoglobin. It is possible to photo coagulate within the area containing luteal pigment (macular) without inner retinal coagulation and it has been shown that irradiation of retinal vessels cause no focal damage. There is also less attenuation of the incident energy by the inner retinal layers or focal damage to the ganglion cell areas.

There is high uptake by the choroid of the krypton radiation. Krypton laser (Bird and Grey) may be useful in the management of parafoveal disciform lesions.

Advantages of Krypton (Red) Over Argon

1. Reduced risk in the inner retinal photo coagulation, especially at macular (no absorption by Xanthophyll.
2. Less consequent hazard of foveal denervation and intra-retinal fibrosis.
3. Lack of uptake in haemoglobin.
4. High uptake in choroidal is an additional advantage in closing the choroidal vessels from which these neo-vascular tissues arise.

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