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Arthroscopic meniscectomy using Holmium Yag laser

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Holmium Yag lazer kullanarak artroskopik menisektomi

Biz 40 holmium yağ lazer menisektomisiyle 40 mekanik menisektomiyi karşılaştırdık. Lazer menisektominin ortalama süresi 10 dakikalık mekanik menisektomiye göre 12 dakika idi. Sadece bir vakada, baloncuk fenomeni nedeniyle lazer menisektomi imkanısız idi. 2 vakada da kartilaj'da yüzeysel termal değişiklikler oldu. Lazer grubunda effüzyon daha nadir ve daha az önemliydi. Ağrı farkı istatistiksel olarak anlamlı değildi. Lazer grubunda normal eklem hareketlerine dönüş çok hızlıydı. Holmium Yag lazer güvenli ve etkilidir ve sonuçlar mekanik enstrümanlardan biraz daha iyidir. Maalesef maaliyeti çok yüksektir ve kullanımı sınırlamaktadır. Mamafih menisektomi lazer sistemini tek avantaj değildir. Sinovektomi, lateral release, kartilaj tıraşlaması ve hafta kemik abrazyonuna da lazer etkilidir.

Anahtar kelimeler: *Artroskopi, menisektomi, Holmium yag lazer*

Arthroscopic meniscectomy using holmium yag laser

Our prospective study compare 40 holmium yag laser meniscectomies with 40 mechanical meniscectomies. Mean duration of laser meniscectomy was 12 minutes againts 10 minutes with the mechanical instruments. In only one case, laser meniscectomy was impossible due to air abuble phenomenon and two superficial cartilaginous thermal changes were observed. In the laser group the effusion was less frequent and less important. Pain difference was not statistically significant. Return to range of motion was very fast in the laser group. Helmium Yag laser is safe and effective and results are a little bit better than mechanical instruments. Unfortunately, the cost remains very high and limits its use. However, meniscectomy is not the only advantage of laser system. It is effective for synovectomy, lateral release, cartilaginous shaving, and even bone abrasion.

Key words: *Arthroscopy, meniscectomy, holmium yag laser*

Before discussing the preliminary results of meniscectomy using Holmium Yag Laser, I would like to give you some theoretical aspects about laser surgery.

The word Laser is an acronym which stands for Light Amplification by Stimulated Emission of Radiation. A laser is a devicef that generates in intense beam of light. The atomic mechanism is follows. If an atom is in an excited state, and if this atom is struck by another photon of laser energy before it goes back to the ground state, two photons of equal frequency and energy, travelling in the same direction and in perfect spatial and temporal harmony are produced.

All lasers are made of the same basic diagram, in that you have a resonator cavity. Inside the cavity is the laser mechanism. On either end of the resonator you will find two mirrors. The laser medium can be gas (For instance CO2), liquid or solid. an example of solid laser medium is Holmium Yag. Yag is a Ytrium. Aluminium Garent erytal and it is dopped with a rare earth element, that is to say: Holmium when the laser medium is excited by the external power supply, then the photons that are created, begin bauncing around in the resonator cavity through the partially reflecting output, as a beam of laser light.

The light is coherent, monochromatic, and collimated.

Coherent means that the light waves are in phase both in space and time.

Monochromatic means that there is only one wave length.

Collimated means that the beam remains perfectly parallel with minimum loss of power due to divergence.

We must underline that the wave length depends on the laser medium determines their effect on tissue and consequently their application. Absorption of water (tissue is 70 to 80% water) is high for the Holmium laser (2,1μ) and even higher for the CO2 laser (10.6μ). The different wavel ength characteristics also give you a different depth of thermal effect in tissue.

Several lasers have been used for meniscal surgery under arthroscopic control.

Theoretical advantages of laser surgery are:

- better access to posterior meniscal lesions, particularly on the medial side.

- thin instruments which avoid cartilaginous damage

- hemostasis in case of hemorhage thanks to the thermal effect of the laser.

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* *"Laser versus others in Artroscopic Meniscal Surgery" konulu Panelde de sunulmuştur*

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CO2 laser and Neodymium Yag laser have been first used. CO2 laser cuts very well the meniscal tissue and the thermal effect is very low but the delivery system is quite complex, using an articulated arm. The beam is finally directed through a lens which focuses the beam down to the specific tissue. Due to its absorption in water medium, arthroscopy must be carred out with gas medium.

Contary to CO2 laser, Neodymium laser whose wavelength is 1.0μ is a contact laser. The beam is guided through a handpiece which touches the tissue. This is a great advantage but the wavelength is not adapted to meniscal or cartilaginous tissue, and the thermal effect is rather important: 2 to 5 mm of depth.

Holmium Yag laser combines the advantages of both CO2 and NeoYag laser. Holmium Yag laser is a near contact laser. Its wavelength is adapted to meniscal tissue and has a thermally affected area of only 0.5 mm. since it's a near contct laser, arthroscopy can be done under liquid medium, that is to say saline medium.

Section, and coagulation are the consequences of a basic vaporization phenomenon. This is obtained by very brief and repeated high energy pulses. It's the reason why Holmium Yag laser is called Pulsed Laser. This pulsed system allows to reach high energy but to limit thermal effects.

Since we use a handpiece, the operative technic is quite the same as with mechanical instruments. The laser beam can act as scissor (section), or as a basket punch by progressive vaporization.

Results

Our prospective study compared 40 Ho Yag laser meniscectomies and 40 'mechanical" meniscectomies, using at than time a 15 watts laser. Mean age was 49 in the laser group and 45 in the mechanical group. Patients were not rantomly selectioned.

There quarters of the lesion were medial and two-thirds were Meniscal degenerative lesions as deseribed by H. dorfmann.

We evaluated

- duration of meniscectomy

- intra-operative complications

- pain, range of motion, effusion at 10 days and 1 month. Pain was assessed, using an analogic scale.

- return to work

Mean duration of laser meniscectomy was 12 minutes against 10 minutes with the mechanical instruments. In only one case, laser meniscectomy was impossible due to a bubles phenomenon which hindered a good visualization. Two superficial cartilagious thermal damages were observed without consequence. There were no other intra-operative complication.

In the laser group effusion was less frequent and less important. At 10 days, respectively 20 and 30 cases. At one month, 6 cases and 24 cases.

Pain level was respectively 2.1 in thelaser group and 2.85 in the mechanical group at 10 days. At one month, 1.0 and 1.68. The difference is not statistically significant.

Return to a normal range of motion was very fast in the laser group. Mobility was limited in only two cases at one month.

Finally the return to work was 10 days in average in the laser group and 16 days in tho mechanical group.

Discussion

Our results are comparable with those of Dilhingham and Fenton, in terms of pain, effusion and range of motion.

Mean duration of meniscectomy is the same in both groups. The cartilaginous burns were unfrequent, superficial and without consequences. Functional results are good. Holmium yag laser is then safe and effective, and results are a little bit better than those obtained with mechanical instruments.

Unfortunately, the cost remains very high and limits its use. However, veniscectomy is not the only advantage of laser system. It's effective for synovectomy, lateral release, cartilagenous shoving and even bone abrasion. But in this bony indication, we need a 60 watts power laser. The risk of overuse is important, particularly for cartilagious shaving. We didn't made clinical study but contrary to mechanical shaving it has been told laser shaving induced regeneration of new cartilage. In vitro and animal studies support this opinion but clinical studies must be done in order to evaluate the reality of this property

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