

Review Article

Hossam's Far-Infra-Red (FIR) Laser Injection Therapy Repairs & Rejuvenates of the Deep-seated Lesions of the Orthopaedic Diseases: Granted US Patents Review

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Abstract: Infra-red (IR) laser therapy has a good reputation for healing and regeneration of damaged tissue. Many clinics in the US and Canada utilize this modality for treating arthritis (painful joints). This method has nearly no side effects if properly used. Indeed, it is very effective if the affected lesion is superficial or very near to the skin. Unfortunately, this method has a critical drawback. Its penetration capacity is limited to about 3.5 cm. Therefore, any lesion deeper than that, the treatment becomes useless. Granted US patents had been issued to solve that problem. These patents include (US 9795802, US 9579520, US9433798). They invented a long-beveled needle that could bypass the skin, subcutaneous tissues, muscle layer (s) if is present, and any other intervening tissues. The laser beam goes directly to the exact site of the lesion. Thus, they solved the problem of the prior art of infrared laser therapy. This also means the full amount of IR laser energy is saved from being lost in the skin and/or any other intervening tissue between the skin and the lesion. This new modality can cure the deep-seated and damaged tissues of the orthopedic system without any side effects if properly used. Therefore, the medication and surgery which are the main lines of treatment of orthopedic diseases could be avoided or at least reduced to the minimum. Lastly, this novel method is essential for the group of patients who are inoperable or are in their end-stage. Examples of these patients include end-stage renal failure, hepatic failure, heart failure, or stage IV of metastatic cancer. These patients may be in a severely painful condition because of arthritis but surgery and/or medication may not be allowed.

Keywords: Infrared Laser, Visceral Fat, Osteoarthritis, Osteomyelitis, Lumbar Disc, AVN

1. Introduction

Infra-red (IR) laser has a great beneficial effect on the recovery of damaged tissues. It is considered very safe, effective, and non-invasive at the same time [1]. The only drawback of this method is that it has a limited tissue

penetration capacity. The type of infrared laser with the highest tissue penetration is the near-infra-red laser (NIR laser) which is about 3-5 cm. All the other types of infrared lasers have a very limited tissue penetration capacity [2]. Some studies claimed that increasing the *intensity* of the laser beam may enhance tissue penetration [3, 4]. This is *partially* true but with certain limitations. The absorption of IR laser depends mainly

on the *wavelengths* that could not be changed. The other limitation is the skin that has a little water content compared with the subcutaneous and the other tissues. This means that high-intensity laser can burn the skin very easily. The skin also absorbs 50% of the energy of the infrared laser and the other 50% goes to the remaining tissue. This is why (IR) laser therapy is limited to the skin and subcutaneous tissues [11, 12]. Therefore, it is limited mainly to cosmetic purposes [5]. It is rarely used in the orthopedics system except if the affected lesion is very superficial. This means that in the case of the deep-seated lesion, (IR) laser is ineffective or may give very negligible results. This is why the Patents subject of this paper are issued. They for the 1st time could *bypass* the skin, subcutaneous tissues, and sometimes the thick muscular layer (s) to reach directly to the site of the lesion of interest. It may be eroded cartilage, swollen synovial membrane, tendon, ligament, or any other damaged structure. This solves the problems of all the prior art patents in avoiding skin damage by an infrared laser. Moreover, it also avoids 50% of the energy lost in the skin. Furthermore, the laser beam can go *as deep* as possible to the exact site of the lesion allowing its prompt recovery and healing. This is why it is expected that this new modality could make a great leap in orthopedic diseases without a need for either medication or surgery. It must be noted that this new modality could *only be* used for the cold cases of orthopedic diseases. It is not used in the trauma sector of the orthopedic system where *internal fixation* is the only solution. Examples of orthopedic diseases that fit with this new modality are osteoarthritis, osteoporosis, sciatica, carpal tunnel syndrome, coccydynia, osteomyelitis, plantar fasciitis, supra-spinatus tendonitis, patellofemoral maltracking, avascular necrosis (AVN), delayed or non-union of the bone fractures [6-8]. From the above, it is shown that most orthopedic diseases could be treated by this new modality. This is not only effective, fast, and cheap at the same time but also it is considered nearly without side effects if it is properly used.

It is sometimes more effective than medication and surgery which are considered the main lines of treatment. Lastly, it is urgently needed for some end-stage conditions where surgery or medication may not be an option. Examples of that are end-stage renal failure, hepatic failure, heart failure, or the 4th stage of metastatic cancer patients. These patients may be in severe pain and could not tolerate surgery or even medication for controlling the pain. This new modality may be an excellent choice.

2. The Thermal Effect of the Infrared (IR) Laser

2.1. IR Laser Therapy Is Not Ionizing Radiation

Infra-red (IR) laser is considered as thermal therapy and not ionizing radiation. All electromagnetic fields do their actions through their effects on the peripheral electron (s). The ionizing radiations are dangerous because they lead to tissue damage and in the long run they may be even cancerous. They all have a mutual effect in high frequency and very short wavelengths. They include ultraviolet rays (UVR) and X-rays. They have high energy that can kick the electron out of the atoms. Thus, the atoms become ionized (positively charged). This is because the kicked electron is negatively charged and the remaining atoms become positively charged which is the meaning of ionization [9]. These positive ions are unstable and always seek stability through getting a negative electron (s) from nearby structures. If they get that electron (s) from the negatively charged DNA, it may be damaged and even fractured e.g *hypomethylation*. This is one mechanism of activation of the *LINE-1 gene* which is the hypomethylation gene and prevents the repair of the DNA. By the way, LINE-1 is the abbreviation of the Long Interspersed Nuclear Element-1 gene [10].

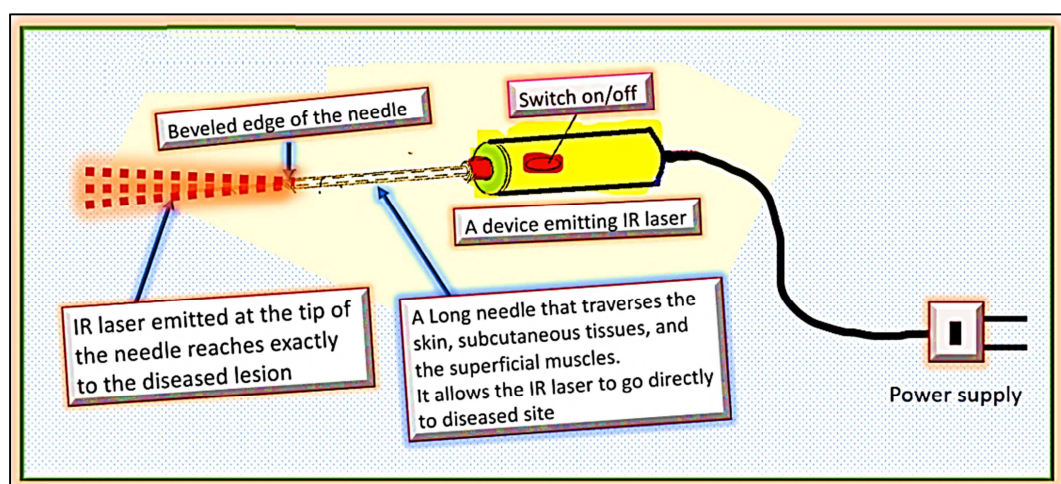


Figure 1. Infra-red (IR) laser Device emitting IR laser at its beveled tip. It has a connection to the power supply of the wall. It also has a switch on / Off button.

2.2. IR Laser Is a Thermal Wave

IR laser is not visible by the human eye as its name

implies because the human eye can see only from red to violet. Therefore, both UVR & IR are beyond the visible field. IR laser itself has a very wide range of wavelengths of

about (700nm-1mm). The frequencies are also of a very wide range of (4.3×10^{14} to 3×10^{11}). The effect of infrared laser, in general, is the vibration of the peripheral electrons. This means that the peripheral electron gets extra energy and goes to a higher orbit. Then, it returns back to its original orbit and emits all the excess energy in the form of IR photons that could be used by the mitochondrial enzymes to enhance energy production. This means the presence of surplus ATPs that could be utilized for the repair of the damaged tissues [13].

3. The Types of Infrared Laser Therapy

Infra-red (IR) lasers that have medical benefits are of 2 main categories. Near-infrared (NIR) & far-infrared (FIR) laser therapy.

3.1. Near-infrared Laser Therapy (NIR Laser)

This type of IR laser therapy has a range of 700nm-2500nm. It has the highest penetration capacity into the tissue 3.5 cm. As said earlier, it causes the peripheral electron to vibrate and its vibration leads to the emission of

infrared photons to the surrounding tissues. The damaged or diseased tissues are eager or in desperate need of any energy. Thus, they could use this energy for biological requirements. This mechanism is done via the activation of the mitochondrial enzymes that produce surplus ATPs [14].

3.2. Far-infrared Laser (FIR Laser)

FIR has less penetration power than NIR. Its range is from 4u-1mm. Its effect on the peripheral electron is vibration like that of NIR laser but it has more of an additional and very fundamental movement which is the *spinning* of the peripheral electron. This spinning raises the temperature inside the atoms. This elevated temperature is called local thermal therapy (LTT). It causes conformation of the protein namely (RUNX2) which becomes activated. Therefore, RUNX2 is only stimulated by FIR laser and not NIR one. RUNX2 has a fundamental role in the treatment of osteoporosis because it stimulates stem cells to build osteoblasts which are bone-forming cells. It must be noted that RUNX2 acts against zinc finger protein which is the gene that converts stem cells into fat cells which explain the obesity that may occur in the elderly [15, 16].

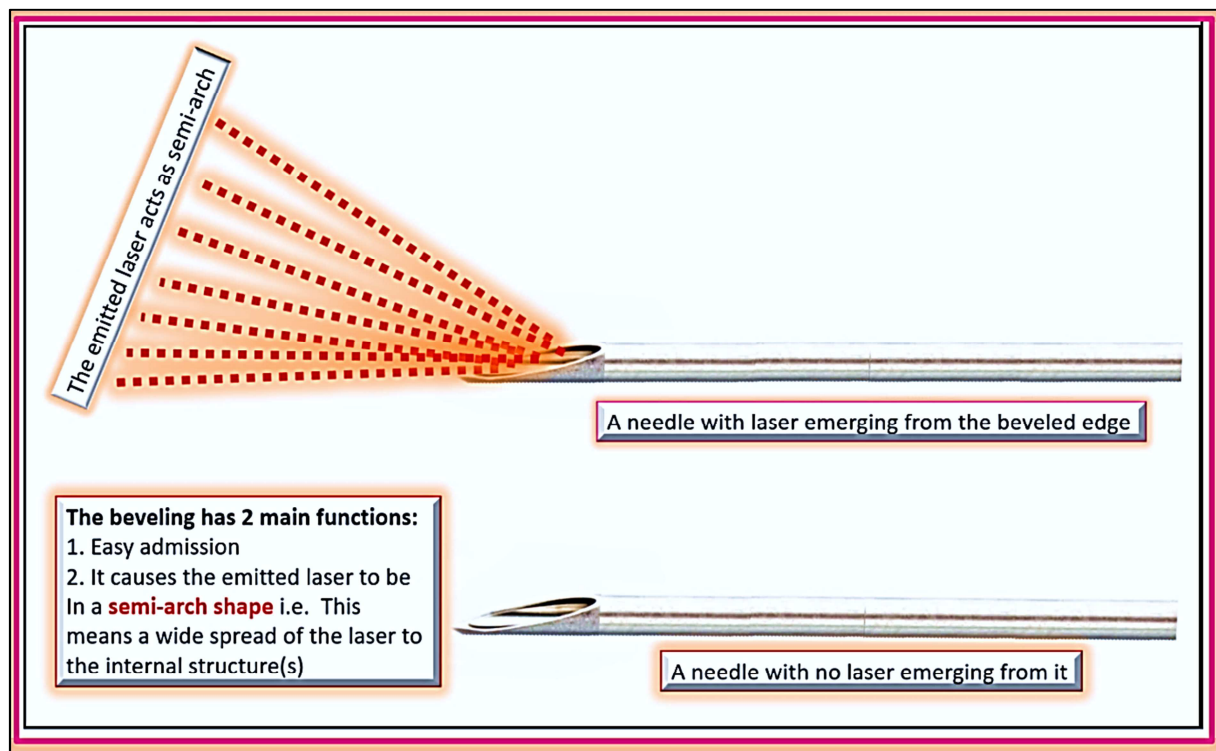


Figure 2. The mechanics of the bevelling of the needle. to allow the spread of internal IR laser in a semi arch-shaped beam.

3.3. Mid-infrared Laser (MIR Laser)

Its range is 2500-4000nm. It is not discussed much because it has a low penetration capacity as that of (FIR). Moreover, it can *not* stimulate (RUNX2). Therefore, it gets the drawbacks of both (NIR) & (FIR) with no extra benefits. This means that the MIR laser gets only the drawbacks of other wavelengths with no specific new benefits.

4. The Molecular Effects of Infrared Laser

The infra-red laser does its beneficial effect on tissue healing via a different mechanism that differs according to the tissues. There is a common mechanism of action which activation of nitric oxide synthase (NOS). This enhances the

production of nitric oxide (NO). The minimal increase of the (NO) oxide has a healing effect on most of the human tissue.

In 1988, Nobel Prize is awarded to doctors who discovered the rejuvenation effect of (NO) [17, 19].

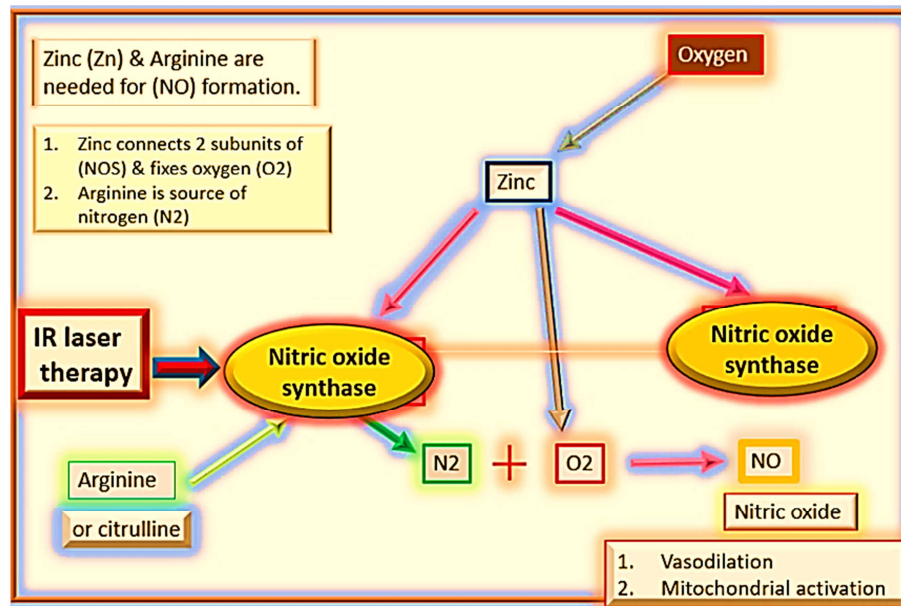


Figure 3. IR laser has a stimulatory effect on the nitric oxide synthase (NOS) with subsequent production of nitric oxide. It has a vasodilation effect and mitochondrial enzyme activation.

4.1. The Effect on the Mitochondria

The mitochondria are the powerhouse of the cells. Their enzymes for energy production are greatly improved by the application of infrared laser. This is done via an increase of (NO). It must be noted that the intensity of the applied IR laser must be between 200-400 mW. The higher the intensity more than 500mW is, paradoxically, associated with suppression of the mitochondrial enzyme. The possible explanation is excess (NO) blocks the mitochondrial enzymes [18].

4.2. The Effect on the Blood Vessels

IR laser also causes an increase in the (NO) via activation of (NOS) in the blood vessels. The blood vessels are vasodilated. Arterial vasodilation causes an increase in the blood supply which means more oxygen and nutrition to the damaged tissues with subsequent healing. Venous vasodilation is associated with the washing effect of the waste products and the tissue debris that are the source of the pain. Thus, there would be a dramatic enhancement of the pain from the 1st few session of infrared laser application [20].

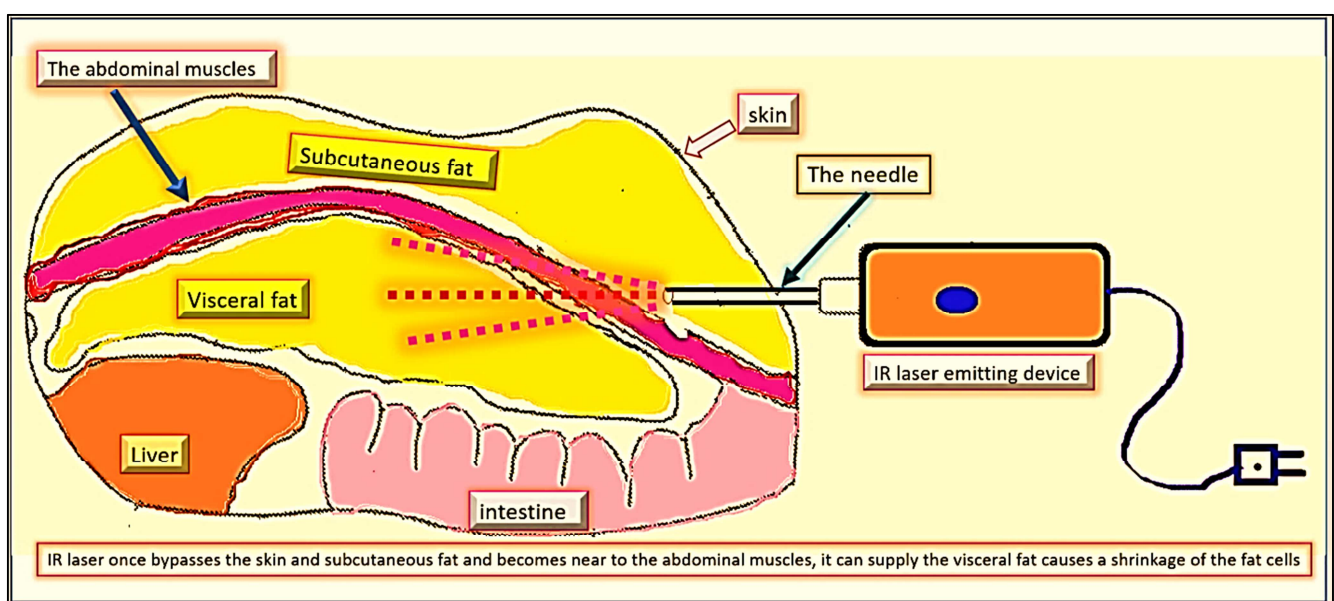


Figure 4. Infrared laser effect on the Visceral Fat. The visceral fat is responsible for all metabolic syndrome (X).

4.3. The Effect on Fat Cells

IR laser causes an opening of the fat channels. This has a fundamental importance in rejuvenation. The fat cells are vital for healthy life provided that they are not fully distended. The normal fat cells secrete *adiponectin* protein which is essential for proteins, carbohydrates, and fat metabolism. If the fat cells are distended as in the case of obesity, the fat cells secrete tumor necrosis factors (TNFs) instead of the adiponectin with subsequent subclinical inflammation that is responsible for the metabolic syndrome (X). These diseases include Alzheimer's, Coronary artery diseases, arthritis, osteoporosis, tendonitis, and others. Thus, infra-red laser application could avoid all these complications by opening the fat channels. Moreover, the utilization of fat as a source of energy gives a surplus amount of energy. It is known that carbohydrates give 4 Kcalories for 1gm while fat gives 9 Kcalories. As the surplus amount of energy is associated with more healing of the damaged tissues [21-23].

4.4. The Effect of IR Laser on the Stem Cells

IR causes growth and differentiation of the stem cells. It must be stressed on a very important point that NIR causes

proliferation and differentiation of the stem cells. FIR laser does the same plus it causes *rejuvenation* of the stem cells. The adult stem cells could repair a specific type of tissue while the juvenile stem cells could repair any type of tissue damage. This opens a new gateway for rejuvenation via the FIR [24, 25].

5. The Patented Device and Its Application

5.1. The Description of the Device

The device (figure 1) is a source of the infrared laser as a very narrow beam. The device is connected with a wire to supply it with the electric supply from the wall. A long needle is mounted on the site of the emergence of the IR laser. The device has a button of a switch on/off. On the connection of the device to the power supply and pressing the switch on button, an infra-red laser is emitted from the device. If the needle is connected to the device, the IR laser is emitted from the beveled tip of the needle. The emitted IR laser shows $\frac{1}{2}$ arch-shaped manner. Also, on pressing the switch-off button, the infra-red laser beam is stopped.

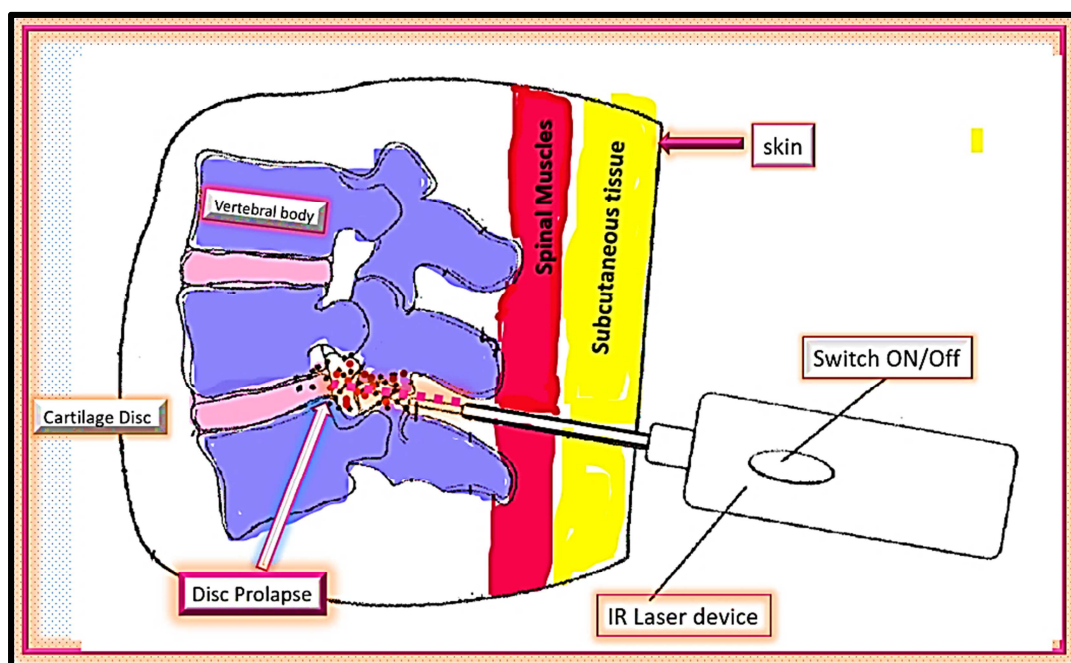


Figure 5. The infrared laser injection can be used for the treatment of Lumbar Disc Prolapse. This could be associated with prompt healing.

5.2. Application of the Device to the Diseased Site

The mechanism is considered *minimally* invasive which means the application of local anesthesia to the skin. Then, allowing the passage of a needle long enough to reach the exact site of the lesion or just near to it. The needle is connected to a device of the source of a narrow infrared laser beam of the device. The device is switched on for 10-20 minutes. As said earlier, the emitted beam is in $\frac{1}{2}$ shape.

Therefore, to spread the beam to include a larger surface area of the internal damaged area, the needle could be rotated. Thus, the emitted energy could cover 360° of the damaged zone. Then, the device is switched off and the needle is extracted. The session could be repeated once per week in moderate cases and maybe twice per week in severe cases. This treatment could last for 6-8 weeks. It is expected that the damaged tissue (s) would recover fully by the end of this treatment.

5.3. The Mechanical Effect of the Bevelling of the Needle

The needle tip is obliquely cut. This is known as bevelling. This has 2 main important functions; 1st is its easy penetration of the skin. The 2nd and the most important is the spread of the infra-red laser at the tip of the needle in the form of $\frac{1}{2}$ arch as in figure 2. The spread-out that occurs at the tip of the needle has a great beneficial effect. This allows the treatment to occur in the large surface area of the deep-seated lesion. Moreover, the zone of the whole 360° could be completed by the rotation of the needle in its position. It must be noted that all the prior art devices have an infrared laser that gradually fades out till their disappearance.

6. Discussion

This new modality of treatment has a great benefit to the diseases of the orthopedic system, visceral fat, stem cells, and senescent cells. The effect on the above systems is done via the activation of the retrograde axis of the mitochondrial-nuclear cross-talk as will be discussed in detail [42].

6.1. The Retrograde Mitochondrial-nuclear Cross-talk

This is the main effect of IR laser. It stimulates the mitochondrial enzyme to produce more ATPs which include cytochrome oxidase, ATP synthase, and most importantly nitric oxide synthase. As in figure 3, nitric oxide synthase is very sensitive to IR laser. It is stimulated and produces more of (NO) that could activate the ATP synthase and cytochrome oxidase. The net result would be surplus ATPs. The cells feel prosperity and the surplus energy is used in the process of repair and rejuvenation of the damaged tissues [26, 27].

6.2. The Orthopedic Diseases That Could Be Carefully Treated by This Novel Modality

Most cold cases of orthopedic diseases could be treated by this Novel modality. These diseases include:

1. *Osteoarthritis* especially that of the knee is considered the most prevalent type of OA in the elderly. The effect of IR laser injection therapy causes activation of the chondrocytes to repair the damaged cartilage. It also causes stimulation of the synovial membrane to secrete the synovial fluid which is viscid material. The function of the synovial fluid is to lubricate the joint which reduces the friction and subsequently the pain. The synovial fluid also enhances oxygen and nutrition to the damaged tissues of the joint. Thus, the repair process is augmented. The increased venous supply carries the waste products that are responsible for pain. Therefore, the pain greatly improved [28].
2. *Patellofemoral maltracking* is the commonest cause of anterior knee pain. Recent studies show that the pathology of this disease is caused by ischemia of the lateral retinaculum of the knee. This causes stricture of the lateral retinaculum with a subsequent shift of the patella laterally. This causes an imbalance in the patellar movement with more friction on the undersurface of the patella. Osteoarthritis may develop later in the undersurface of the patella which causes the flexion and extension of the knee to be very painful. This is exaggerated by going on upstairs and/or downstairs. Thus, an IR laser corrects the disease from its root by increasing the blood supply to the lateral retinaculum of the knee. As said earlier, the triggering point of this disease is ischemia of the lateral retinaculum [29].

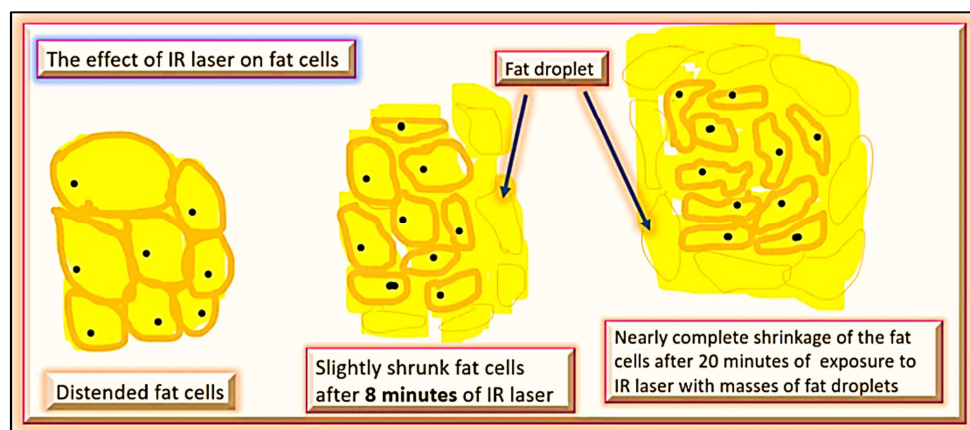


Figure 6. The effect of an Infrared laser on the fat cells is the opening of fat channels. This means shrinkage of the fat cells.

3. *Non-union or delayed union* of bone fracture. IR laser enhances the vascularity at the site of non-union and allows the osteoblasts to proliferate. Recent studies show that the *RUNX2* gene could be stimulated by an FIR laser and directed the stem cells towards osteoblasts. Figure 7, *RUNX2* does this job via inhibiting the zinc finger protein. The latter causes the stem cells to be directed towards the formation of the fat cell [30].
4. *Avascular necrosis (AVN)* is a catastrophic disease, which is the death of some areas of the bone but without bacterial infection. The exact pathological process is not known but it may be blocking the vascular supply via fat droplets. The early stages of this disease could be cured by the utilization of an IR laser. The explanation may be vasodilation of the blood vessels. It may be also a proliferation of the stem cells towards the osteoblasts rather than towards the fat cells [31].

5. *Osteomyelitis* is a bacterial infection of the bone. The only treatment of this disease is the surgical removal of the necrotic bone with surgical insertion of long-acting antibiotics. The catastrophic effect of this disease is that the bacteria have a biological membrane. Thus, they become away from the immune system and the systemic anti-biotics. Local application of IR laser damage this membrane and allows the antibiotic to enter and kill the bacteria with subsequent healing of the lesion [32].
6. *Low back pain* with or without a disc prolapse can be treated successfully by this method. The disc prolapse is usually treated by conservative measures that have a success rate of more than 85% in most cases. The external utilization of the IR laser may be useless because the distance between the skin and the site of the prolapsed disc may be 7 cm or more according to the obesity of the patient. IR laser injection therapy brings the IR energy just near to the exact site of the prolapsed disc as in (figure 5). It allows the chondrocytes to repair the cartilage. The increased blood supply gives oxygen and nutrition to ischemic diseased cells. Moreover, the enhanced venous return removes all the waste products and metabolites that cause the pain. Thus, the pain would dramatically improve [33].
7. *Plantar fasciitis* is a hook of the calcaneus bone due to traction by the plantar fascia. The medical treatment usually fails and surgical treatment is the excision of this hook. IR laser applied externally may not be effective because the skin of the heel is very thick. IR laser injection can bypass the thick skin and underlying tissue to reach exactly the calcaneal spur that causes the pain. Increased blood supply by IR laser leads to an increase of oxygen and nutrition to the affected area and accelerates the healing. It also increases the venous return that causes a washing effect of the mediators that cause the pain. Therefore, a healing effect is expected and pain subsides [34].
8. *Coccydynia* is severe pain in the coccyx (tail bone). It usually occurs in women after birth. It also may be caused by falling down on the coccyx. The medical treatment may fail. Local injection of cortisone and local anesthesia may be tried but also usually fail. Even surgical removal of the coccyx may not heal the condition. IR laser injection therapy has a very good probability to be the standard treatment of this condition. It allows a local enhancement of the blood supply. Thus, the arterial supply provides the damaged tissues with oxygen and nutrition. This allows the damaged tissues to heal. The increased venous return causes the washing effect of the metabolites that are responsible for pain. Thus, the pain would also subside in association with the healing process [35].
9. *Supra-spinatus tendonitis* is caused by ischemic edema of the supra-spinatus tendon. This is associated with impingement of the tendon in the *sub-acromial* space. This would further compress the blood supply of the tendon with more edema and a vicious cycle would occur. Application of infra-red laser from outside may not be helpful because of *thick deltoid muscle* that would absorb all the energy. As it is known, the supraspinatus tendon is

covered by the thick deltoid muscle. Therefore, IR laser injection has a great beneficial effect as it exactly treats the condition root. As said earlier, it is started by vascular insufficiency that causes edema of the tendon of the supra-spinatus. IR laser injection has a long needle that bypasses the skin, subcutaneous fat, and thick deltoid muscle. The emitted IR laser goes directly to the supra-spinatus tendon. It enhances the blood supply of the ischemic tendon and causes edema to subside. The enhanced venous return also washes the metabolites that are responsible for pain. Thus, the pain would improve with the healing of the damaged tissues [36].

10. *Carpal Tunnel syndrome* is the tightness of the transverse carpal ligament that causes compression of the median nerve. It is known that this nerve supplies the lateral part of the hand and lateral 3 and ½ fingers which means the thumb, index, middle, and only ½ of the ring finger. Tingling and numbness usually occur in the areas of the distribution of the median nerve. As the nerve is just under the transverse carpal ligament, ordinary IR may be beneficial. Sometimes, this ligament is *calcified*. Thus, it needs surgical intervention. *IR laser injected therapy* would be an excellent alternative. This can be done via injecting the infrared laser just under the calcified ligament. The increased blood supply could repair the condition. Thus, the patient could avoid the surgical intervention [37].

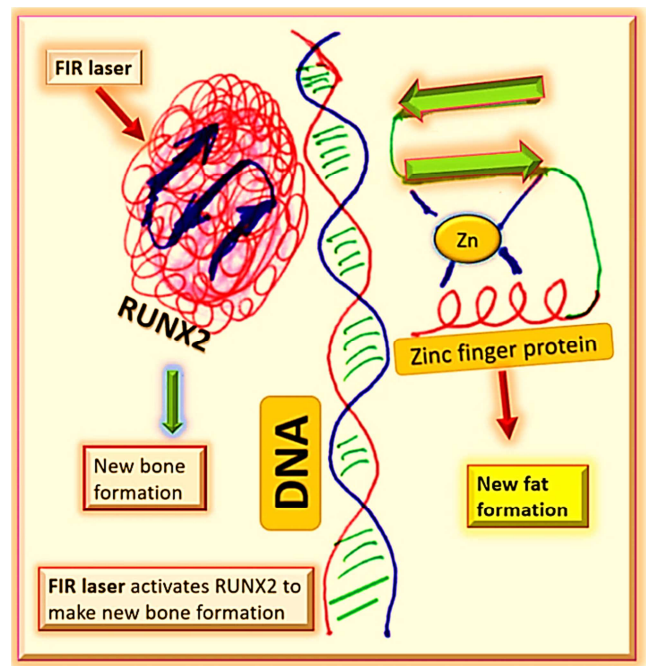


Figure 7. The effect of far infra-red laser on activation of RUNX2 with subsequent new bone formation.

6.3. The Effect on the Visceral Fat

The fat is of 2 main types namely; subcutaneous and visceral fat. The subcutaneous one is benign and is metabolically inert. This type is accessible for surgical removal in the process of liposuction. On the other hand,

visceral fat is inside the viscera like the liver, pancreas, omentum, wall of the intestine, and even pericardium. This type of fat is inaccessible for surgical removal. Moreover, it is *metabolically active* which means it secretes cytokines called tumor necrosis factors (TNFs). These initiate *subclinical inflammation* all over the body. These are responsible for metabolic syndrome (X) as in figure 8. These include the chronic diseases that occur in the elderly and could be modified by changing the lifestyle, cut-of

carbohydrates, prolonged fasting, and making exercise. These diseases are Alzheimer's, coronary artery diseases, arthritis, osteoporosis. IR laser injection therapy opens fat channels and causes the fat cells to shrink as in (figure 6). This is considered a leap of modern medicine in that visceral fat could be gotten rid of with a few sessions of 20 minutes of infrared laser injection. This course may be repeated weekly till the visceral fat is completely diminished [38].

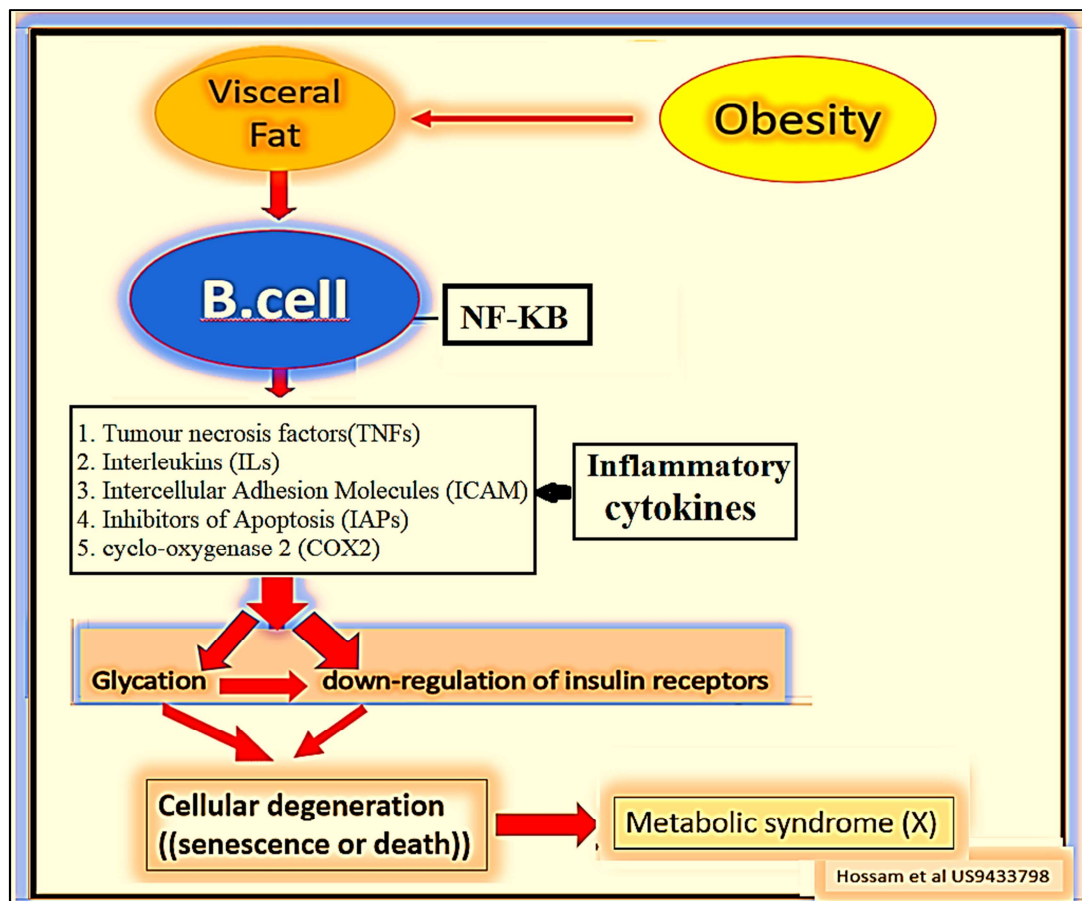


Figure 8. The mechanism by which visceral fat can initiate all metabolic syndrome (X). IR laser could be considered as the only cure of visceral fat by shrinkage of fat cells.

6.4. The Effect on the Stem Cells

Stem cells are dormant cells that act as spare parts to repair the damaged tissues. There are many types of stem cells. Two types would be discussed here which are the adult and the juvenile types. The adult type could repair a certain type of tissue only. For example, adult cardiac stem cells could repair only heart muscles, adult chondrocyte stem cells could repair only the cartilage, adult stem cells of the brain could repair only the damaged brain tissues, and so on. The juvenile stem cells, on the other hand, could repair any issues. Therefore, their activation via IR laser injection therapy causes them to circulate in the blood. They could reach the diseased site and repair it. Recent studies show that the RUNX2 gene could convert the adult type of stem cells to juvenile ones. This also is considered a

breakthrough [39].

6.5. The Effect on the Blood Vessels

IR laser injection therapy enhances vasodilation of the blood vessels. This is caused by the increased production of nitric oxide (NO). Vasodilation has a great beneficial effect in supplying the damaged tissues with oxygen and nutrition. The damaged tissues are usually ischemic and are desperate for oxygen and nutrition. This allows the repair of the damaged tissues. Moreover, venous vasodilation has a washing effect of the removal of the tissues debris and the metabolites that are responsible for pain. Recent studies show that the presence of tissue debris prevents the healing process to be completed. Thus, it is expected that healing would be faster and the pain also disappears very fast [40].

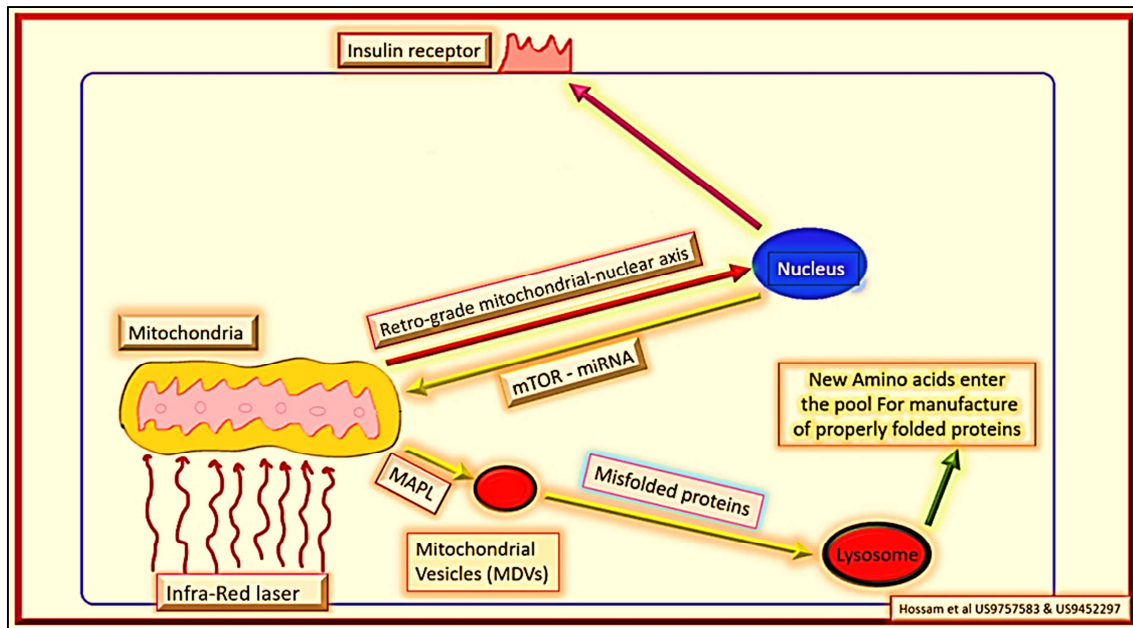


Figure 9. IR laser stimulates the mitochondria that subsequently do all the biological functions of the cells either directly or indirectly through the nucleus.

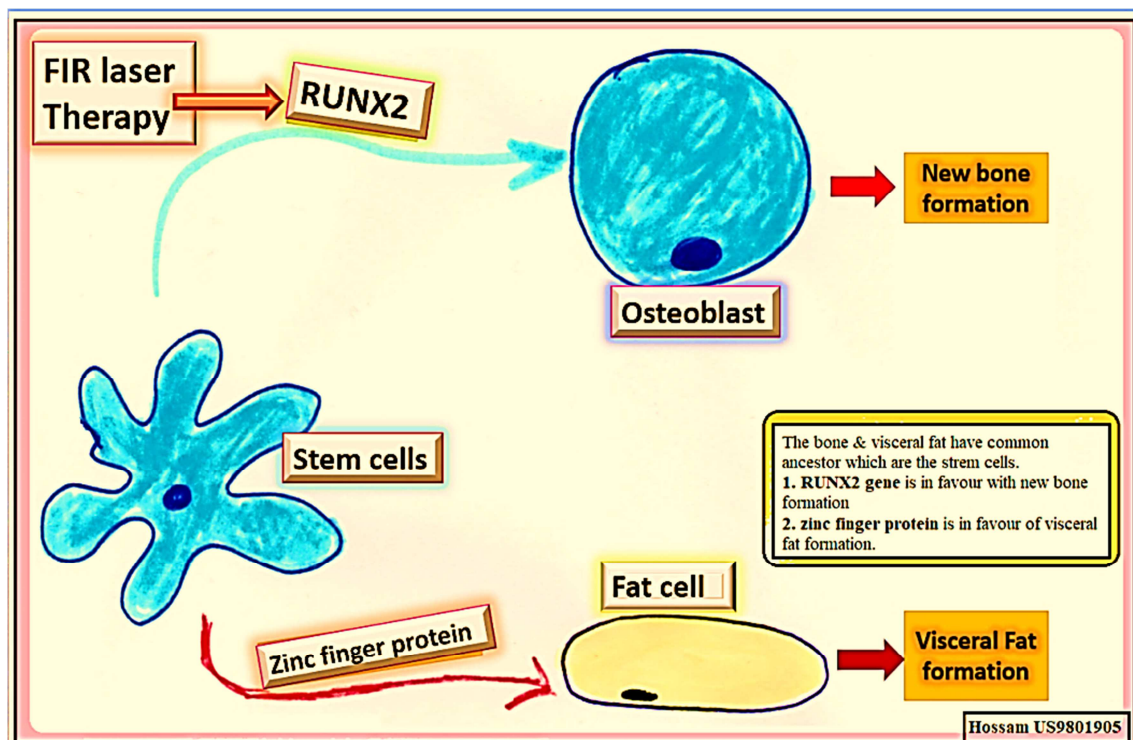


Figure 10. FIR activates RUNX2 causes stem cells to manufacture new osteoblasts and new bone formation. The opposite is done via zinc finger protein that causes stem cells to manufacture new fat cells leading to obesity.

6.6. The Effect on the Senescent Cells

These cells start the aging process. These cells act as Zombie cells that could not die and could not perform their biological function. Moreover, these could infect the nearby normal healthy cells via the paracrine mechanism. IR laser injection therapy stimulates the retrograde mitochondrial-nuclear axis which causes these cells to

commit suicide. This phenomenon is called *apoptosis* or programmed cells death as in (figure 9). Therefore, these cells disappear, and damaged tissue heal again. Recent studies show that senescent cells are full of *misfolded proteins*. IR laser therapy enhances the process of autophagy that sends the misfolded proteins into the lysosome for their destruction. Subsequently, their building blocks of amino acids are added again to the amino acid pool. This enhances

newly formed proteins to be manufactured. It is known that the new proteins are functional and properly folded. Therefore, they can do their proper biological functions [41].

7. Conclusion

Infra-red laser has a great beneficial effect on the healing of damaged tissue, especially the cold cases of orthopedic diseases. Many clinics in the US and Canada use this modality for the treatment of the above diseases. The results are promising in the healing of these diseases without medications or surgery. The only drawback of this method is its efficacy is excellent in the skin and the very near subcutaneous tissues. This means that up to 3.5cm, the healing effect may be expected. In the case of tissue deeper than 3.5 cm, the healing effect would be dramatically reduced till it becomes useless. The subject patents of this paper came to solve the problem. It invented a beveled needle to bypass the skin and subcutaneous tissues to transmit the IR laser directly to the exact site of the lesion. Thus, the healing effect would be expected without the need for surgery or medication. This novel method is highly recommended for non-operable cases with end-stage diseases like end-stage renal failure, hepatic failure, heart failure, and terminal IV stage of metastatic cancer. These patients may be in severe pain but surgery and/or even medication sometimes is not allowed due to the bad condition of the patient. The patented device of this paper may be the only *palliative* choice to control the pain of this patient.

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