Application of Matrix Rhythm Therapy in post-operative knee arthrofibrosis- A Case Report

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Abstract:
Post traumatic, post- operative knee stiffness is quite challenging condition seen in clinical setup for physiotherapists. The purpose of this case study is to put forth newer line of therapy for such kind of challenging cases. In this particular case, patient was given standard routine physiotherapy but patient unfortunately was not getting function and range of motion for one year post traumatic post-operative situation. After the intervention by Matrix Rhythm Therapy with Matrixmobil® patient improved in range of motion, pain, gait and overall lower limb function. We followed a protocol of 16 sessions once per week for one hour. Modified Cincinnati Rating Scale was used as outcome measure which rated as 40 pre therapy and it was 98 post therapy.

Key words: chronic knee stiffness, arthrofibrosis, impaired function, Matrix Rhythm Therapy

Introduction:
The anterior cruciate ligament (ACL) is one of the most commonly injured ligaments of the knee (1). Approximately 50% of ACL injuries occur with injuries to other structures in the knee (2). Anterior cruciate ligament reconstruction (ACLR) surgery consistently reported as one of the most frequently performed procedures by orthopaedic surgeons (3). Post-surgical treatment mainly consists of Physiotherapy in the form of mobility and strengthening in early phases. Chances of stiffness post ACL reconstruction is 12% post 6 months of injury. Both incomplete attendance at physiotherapy ($p<0.005$) and previous knee surgery ($p<0.005$) were the strongest predictors of the stiffness (4). Arthroscopic arthrolysis, in conjunction with MUA, is an effective treatment for knee stiffness post-ACL reconstruction (5) along with Physiotherapy.

Newer approach to this complication would be application of Matrix Rhythm Therapy (6). Matrix Rhythm Therapy is based on research carried out in 1989-1997 at the department of oral and maxillofascial surgery and trauma surgery of Erlangen University by Dr. Randoll. He focused on the natural rhythms of cells as observed with the help of videomicroscopy and drew essential implications for the rhythmic oscillations. Based on this he developed device called Matrixmobil® for clinical application for various conditions ranging from pains till post traumatic post-surgical problems.

Objective of this study is to present a protocol to treat post anterior cruciate ligament knee stiffness, which was almost there for one year duration from the time of trauma, only with the help of Matrix Rhythm Therapy along with routine physiotherapy management we got significant improvements.

Case presentation

Patient history:

A 17 year old female commerce student had a road traffic accident on her right knee from two wheeler (Date- 9-2-2014). She visited the orthopaedic department with complaint of severe pain around right knee with swelling, inability to walk, severe pain and inability to move her knee. This patient was diagnosed by orthopedician as right ACL avulsion and tibial spine fracture. She underwent investigations like X-rays and MRI for the same and was posted for ACL repair (Date-10-2-2014).

Fig. 1 X-ray of patient in post- operative period

Fig. 2 X-ray of patient after implant removal

Patient was been immobilised for 3weeks post- surgery and after that was referred for outpatient physical therapy department to regain mobility, strength and function after patient was put out of cast. After that brace was been advised. Patient was put under anti-inflammatory medicines were given. Post operatively patient had chief complains of pain, stiffness, swelling, and limited range of motion at right knee joint, with partial weight bearing with the help of walker. Patient had difficulty in activities of daily living such as ambulation, self-care such as toilet and bathing and outdoor activity of attending college she is student.

The goal at the time of evaluation was to reduce pain, reduce swelling, and reduce stiffness, increase mobility and eventually independent weight bearing. She started physiotherapy. But even after 2 months of extensive program her extension was 30 degrees and flexion was only up to 50 degrees. Also had severe pain and swelling. So orthopedician decided to do Manipulation under General Anaesthesia (date- 16-4-2014). Post this also patient was advised physiotherapy in the form of manual therapy, stretching, strengthening, Myofascial release, muscle energy technique, faradic stimulation for quadriceps activation, kinesiotaping.

This was continued till the month of September 2014. Her ROM extension was 15 degrees and flexion was 60 degrees. Her pain was very severe along with swelling. At this stage orthopedician decided for implant removal (date- 4-9-2014) along with inferior free pad excision. After this procedure as well her physiotherapy was continued.

In spite of all these things there was no much improvement in her ROM, pain and swelling.

Her ROM was 15-65 degrees. At this stage orthopedician again decided to go for arthroscopic fibrolysis(date- 16-12-2014). Physiotherapy was on after this procedure as well for almost 2 months. She was referred to me on 2-3-2015 for Matrix Rhythm Therapy.

Clinical examination on 2-3-2014:

On her first visit the condition of her knee was almost same for one year with multiple surgical interventions as well as physiotherapy intervention. She had persistent complains of pain, swelling, stiffness, restricted ROM, difficulty in walking, antalgic gait. Her VAS- 9/10 with activity. At rest VAS was 6/10. She had flexed knee in standing and therefore her hip and ASIS levels were not equal. She started having tenderness at L4-L5 level due to unequal limb length when weight bearing. Her patellar mobility was graded as severe restricted. Her ROM was measured with the help of standard goniometer and flexion was 90 degrees and extension was 30 degrees. Measurements were done in prone and supine position with rest of the body supported on bed. Her hip range of motion was not showing any restrictions. Her manual muscle testing was done for quadriceps and hamstring muscles. It was grade 3 in available ROM. Hip muscle gradation was 5. There was increase temperature around her knee area. And severe tenderness around scar area. Soft tissue assessment of quadriceps, hamstrings, ITB, gastrosoleus muscle revelled severe tightness on palpation. No sensory deficits around knee. Functional outcome measure used for the patient was Modified Cincinnati Rating Scale. Score was 40 which is fair according to grading.

It was therefore determined that the patient’s irritability level was severe.

Intervention:
The patient was treated with Matrix Rhythm Therapy for 16 sessions. The session was for one hour duration. It was planned once per week for almost 4 months duration. The area covered not only periarticular soft tissues in all these sessions like- quadriceps, hamstrings, gastrosoleus, ITB but also around hip area, lower back region as well.

Four times a week she got physio in form of Micro mobilisation (Matrix Rhythm Therapy) combined with macro movement in each session. Routine physiotherapy with other therapist 4 times in a week was continued as before. This was in the form of stretching,

strengthening, manual mobilisation techniques, soft tissue mobilisation, faradic stimulation, kinesiotaping, balance and proprioceptive training, gait training and swimming. This protocol was followed from March, 2015- July 2015.

Also she was been given home program to follow.

Fig. 3 Knee flexion range before starting of Matrix Rhythm Therapy

Fig. 4 Knee extension range before starting Matrix Rhythm Therapy

Fig. 5 Knee Flexion range after application of Matrix Rhythm Therapy

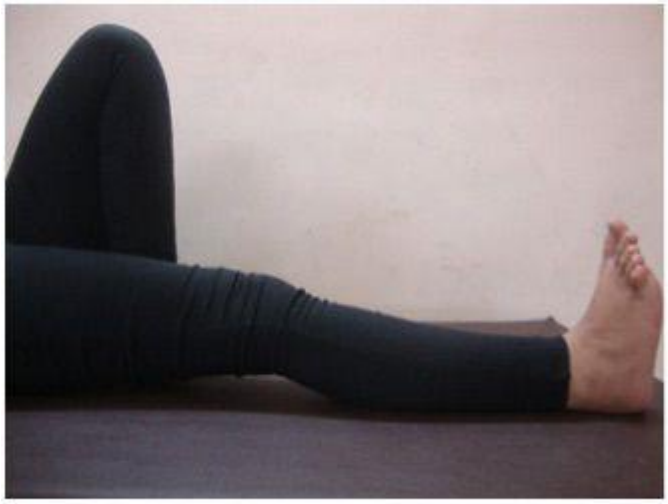

Fig. 6 Knee extension range after application of Matrix Rhythm Therapy

Findings:

In the initial 4 sessions there was no much improvement in her ROM at knee joint. But there was reduction in her pain and swelling. Also there was individual perception of lightness in the limb.

In next 4 sessions her extension range started improving till 15 degrees and flexion was going till 95 degrees

In further 4 sessions her gait pattern started improving. There was reduction in her pain while walking. Her knee extension improved up to 10 degrees and flexion up-to 100 degrees. Her pain while doing physiotherapy also started reducing. Her swelling reduced further and her patellar mobility was improving. There was almost grade 2 mobility which was no mobility on initial assessment.
In last 4 sessions her range and stiffness kept improving further. And we stopped the intervention of MaRhyThe® at this point.

Modified Cincinnati Rating score was 98 which grades as excellent knee function.

Initial examination and reassesment data

Physical examination	Initial evaluation	After 16 sessions of matrix
Pain	9/10 on activity and exercise 6/10 on rest	0/10
ROM- patellar mobility	Severly restricted compaired to other side	Full in comparison to other side
ROM- Knee extension	30	2
ROM-Knee flexion	90	160
End feel- extension	Firm	Firm
End feel- flexion	Strech	Tissue approximation
MMT- quadriceps	3+(in available range)	5
MMT- hamstrings	3+(in available range)	5
Modified Cinncinati Rating scale	40- fair	98- excellent

Discussion:

In this case study patient was referred for Matrix Rhythm Therapy after almost one year of initial episode of trauma. Also patient underwent open procedure under anasthesia for 3 times and once for closed procedure. Routine physiotherapy intervension was also going on for her. In spite of so many things her pain was constant, no reduction of swelling, stiffness and no much imrovement in ROM was seen. Even she had difficulties in ambulation and it was restricting her from getting into social activities. Being young she could not attend social functions and also had restriction of using high heel footware.

With the help of matrix rhythm therapy patient significantly improved in her pain, swelling, stifness, ROM and gait along with routine physiotherapy. To explain the results, the basis on which matrix rhythm therapy is based important to know. If we consider her condition it was traumatic, post operative situation leading to malalingment of knee joint. The primary cause for this malalingment is mainly due to periatricular soft tissue adhesions (arthrofibrosis) which includes joint capsule, ligaments, fascia, muscles and the skin. Pain is out come of such malalingment due to cry of tissue for oxygen and for better metabolism in general. For this quality of extracellual matrix is important for transport of oxygen from cappilary to tissue that is cells. Whenever there is restricted mobility this logistics at cellualr level start getting affected. Physiological processes shift to pathophysiological processes. Oxygen is especially needed for the ATP production inside the mitochondrias to bring contracted muscles back to relaxation. If there is lack of ATP, it remains in the state of contraction and over a period of time becomes hard (rigor mortis). This in turn results in acidic tissue environment and in pain. This leads to permement disturbances. Tissue loses its capacity to adapt and elsticity starting a vicious cycle.

So in order to break this cycle cell process must be activated that means we need to change the microenviorment first. This is target of Matrix Rhythm Therapy where by oscillations to the tissue we can adapt change intracellular environment via extra cellular matrix. So based on this reaserch was done on cellular vibrations and they were found to be in the range of 8-12 Hz. When these vibrations goes out of these perticular range pain, muscle stiffness and movement resrictions begins. This can be called as microscopic basis for macroscopic effect which we see in the form of symptoms. With Matrixmobil we restart and optimize this vibrations, like an carank handle starts an engine, so that muscle cell start pulsating in proper manner improving cellular logistics. This application is done externally. Unlike other physiotherapy modalities this therapy treats the tissues at greater depthsand focusses disturbed micro-processes to start self-organisationso restoring the tissue elasticity.

The matrix concept is based on the reaserch, which was carried out in the period 1989-1997 at Erlangen Univercity. The therapeutic conclusion from this reaserch was that cell processes must be activated as much as possible on a systemic level in order to achieve healing. That means by changing the cellular environment. In 1996 the concept of " matrix therapy" was introduced and gained scientific recognition. This concept expressed the fact that every intervention on a cell- whether preventive, curative, regenerative or also destructive- works primarily via the cell's environment i.e. via extracellular matrix. That is where the therapeutic action has its primary effect, which then leads in turn to effects on the cell. Examined more closely, living structures consisit of precesses which constantly form and transform themselves within a time span of about seven years the body replaces the entirety of its molecular constitutents.

Muscle relaxation is important to improve range of motion at joint. Muscles can be tensed

and relaxed. But if there is insufficient energy, residual contraction and tissue adhesions can remain even after voluntary relaxation. These residues can no longer be eliminated by conscious action. The muscle becomes rigid. Interventin from the outside is necessary to bring about the completely relaxed state, by stimulating the metabolism and restoring cellular logistics. Therefore activating the process of relaxation by intervenng from the outside became the key to an effective therapy.

Rhythms are the key to healthy life. The physiological role of the skeletal musculature and the trembling of muscles is generally accepted. Hence in the context of our systematic investigation of body rhythms we concentrated on the skeletal musculature. In all people healthy muscle vibrate in the frequency range 8-12 Hz. This can be observed directly on cellular level. Muscle cells pulsate. What happens when the rhythm of pulsation changes? It can be shown with the help of piezoelectric sensors that muscle pulsation frequencies which lie outside the 8-12 Hz range correlate positively with pains, muscle tension and other health problems. Changed muscle elasticity and plasticity are linked to changes in pulsation frequency and in the logistics of the living precess on the cellular level.

The human body is a complex system. It consists of 70 trillian cells. These cells are all surrounded by the extracellular matrix. All exchanges and communication, all transport to and from the cells takes place through this matrix. There is no other possibility to reach the cell other than via this transit pathway. The extracellular matrix pervades the entire organism. Cells are dependant on the special enironment in which they have developed and to which they have adapted themselves. Hence the state and the quality of the extracellular medium is a determining factor for our health. Sticking with the metaphor of the fish, we can say: like fish in water, the cells in our body are surrounded by the extracellular matrix. The vital logistics of supply and removal of all substances occures via that medium. The wellbeing of each cell thus depends on its surroundings, just as the wellbeing of fish depends on the quality of the water they are swimming in. these considerations suggest a therapeutic approach focused on the “habitat” of the cell.

Fig. 7 Matrixmobil®

Entrainment signifies the synchronization of cells, organs and organisms by an external rhythm. Matrix rhythm therapy applies the normal physiological muscle frequency from outside, in order to readapt derailed cellular and extracellular processes. In the osteopathy, manual medicine and other physiotherapeutic techniques this effect of MaRhyThe has been recognized and has became an integral part of therapeutic practice in many places. Matrix Rhythm Therapy enables the therapist to treat even the deeper layers of tissues in a

directed, specific and gentle way. The goal is a pain free mode of treatment. Pain evokes corresponding defense reactions and leads to further tension and cramping. This is why a gentle treatment is especially important. Sustained therapeutic success comes when tissue elasticity and plasticity has been achieved in the relaxed state. This reset correlated positively with a favourable supply satus of the cells and is the ideal preparation for renewed training programs.

The treatment described above generates microscopic streching movements (rhythmic micro-extension). The contarction residues are eliminated. The elasticity of the muscle is restored by activating the metabolism on the microscopic level. The cellular logistics are restored and we can move our muscles more freely again. A gradual transition to the next phase of the therapy follows: the macro mobilization of the muscle by the therapist.

Matrix rhythm therapy has proved to be effective in all cases where the symptoms are caused by disturbances in the microcirculation. Since its development at Erlangen Univercity, this therapy approach has become standard in very many areas- especially in the perioperative domain, in trauma surgery, in rehabilitatuion, in pain therapy as well as the treatment of chronic diseases of the nervous system, skeletal and locomotor systems. According to the Matrix Concept, therapists utilize the Matrixmobil both locally and systemically. The aim to stimulate healing processes via entrainment by acting directly on the cell biological level. What therapist dose is above all to create favoirable conditions on the cellular level. The patient is responsible for maintenance of health and prevention via changed behaviour in the area of nutrition, exercise and relaxation.

From a historical stnadpoint Matrix Rhythm Therapy is a vibrational treatment focused on skeletal musculature. In the broadest sense it can be seen as a development of classical vibration massage. Vibration massages are effective methods in the area of rehabilitation and sports. They are naturally very strenuous for the therapist and are limited by their relative inability to access deeper lying tissue.

The reason for the success of Matrix Rhythm Therapy lies in its approach based on cell biology. Matrix Rhythm Therapy stimulates the natural rhythm and indirectly regualates the processes which are coupled to that rhythm. While many treatment methods work with rigidly fixed frequencies, Matrix Rhythm Therapy utilizes the whole “window” of physiological frequencies, thereby allowing the flexible tissue to adapt in a healthy way.

Matrixmobile is a type of massage stick with vibration head which moves back and forth with a frequency between 8 and 12 Hz a frequency that corresponds with that of microvibrations of muscle tissue. Cells which have fallen out of thr proper rhythm are restored to their natural state of vibration. The vibration head has the form of logarithmic spiral. The form is based on golden section and is often expressed in the morphology of plants and animals. The seeds of sunflower are arranged on its branches according to the logarithmic spiral, as are also the eyes on the tail of a peacock. The structure can also be found in the shells of snails and clams. Dr. Randolls design for the Matrixmobil vibration head was inspired by these natural forms.

When the vibration head is applied to the body it generates a harmonic wave pattern which propagates in circular waves through out the body. When the vibration head is moved its special shape generates asymmetrical pressure distribution, including a pump/ suction effect

in the tissue and setting the matrix fluid into motion. The therapeutic effects are suppored by the action of magnet located in the vibration head. Experience and a series of scientific studies have shown that magnetic field promote blood circulation and can alleviate pain. The combined machanical and magnetic vibration mobilizes the connective tissue, and muscular tension is released. The exchange of nutrients and metabolites is also strengthened, as well as the transport of oxygen in the tissue. The cell revert to their healthy natural vibration. Working with physiological frequency and amplitude range is unique feature of matrix rhythm therapy.
In this patients case we needed 16 sessions of one hour duration since her condition could be categorised as chronic and tissue was in very much adapated to the condition of pain and restricted mobility. So the reversal of process took this much duration for therapy.

Conclusion:
Matrix rhythm therapy can be considered as the therapy which can be used in non responding, chronic conditions of knee joint. It is safe therapy. No side effects and patient dosent need this therapy on daily basis. At the same giving near full recovery.

Conflict of interest:

Source of funding: Self funding

Ethical clearence: Written conscent was taken from patient to publish this case study for academic purposes along with photographs.

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