The Science and Clinical Application of Micro-Current Technology:
A Selection of Published Work

Introductory Summary

- Robert Becker wrote the book "The Body Electric" 1975 (now re-printed), in which he proposed that the body possesses a micro-current circulatory system which provides inter-cellular communication. Becker was the first to propose 'current of injury theory' which was re-enforced by others, for example, Illingworth and Barker (1980) who reported a micro-current of 10-50 μA emerging from the healing stumps of children's fingers accidentally amputated.
- On the theme of regeneration Dunn et al (1998) devised a collagen sponge embedded with electrodes that they implanted into full thickness skin wounds. Using 20–100 μA the authors reported that healing was significantly accelerated in comparison with the control groups. Chapman-Jones 1997 and 1998 reported accelerated tendon and skin healing, in both laboratory and clinical studies.
- Lee 1993 suggest for reasons for the mechanism of action for micro-current therapy. Discusses that the cell membrane is the most likely point of manipulation. Therefore, if we can control or manipulate what enters and leaves the cell and hence its biological behaviour is anything possible?
- Reported by Lawrence Altman: Cell Channel Finding Earns Nobel Prize New York Times Medical Science section, October, 9, 1991 Summary: Two German scientists, Dr. Erwin Neher and Dr. Bert Sakmann, will share the $1 million dollar Nobel prize for their development of the patch-clamp technique that allows the detection of minute electrical currents in cell membranes. This discovery, which "revolutionized modern biology", may shed light on the causes of several diseases, likes diabetes and cystic fibrosis. This method allowed the detection of 20 to 40 types of ion channels that allow positive or negatively charged ions into and out of the cells. "This study confirmed that electrical activity is not limited to nerve and muscle tissue, as previously thought, but is intrinsic to 'all kinds of other cells'".
- Chapman-Jones: Treating elite race horse with tendon problems has a remarkable success rate bring horses back to racing with an average of 26 weeks, with a success rate of 85%. The expected rate previous to this is a minimum of 52 weeks with a 30% return to racing rate.

Example Published Paper: Tendon Pathology

Novel micro-current treatment is more effective than conventional therapy for chronic Achilles tendinopathy: A randomised controlled trial.

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Abstract

Background

The healing processes of tendon tissue are not well understood and are reflected in the difficulty of clinical management of this pathology. Previous in-vitro studies have demonstrated that the application of micro-current has the ability to promote protein production (collagen) in fibroblasts and tenocytes. In-vivo studies, using animal models, have demonstrated that tendon and ligament tissue responds particularly well to this application. Thus, the purpose of the study was to evaluate, following the application of micro-current for therapeutic purposes, the functional outcome in patients presenting with chronic pathology in the Achilles tendon in comparison with the current conservative management.

Method

A prospective comparison study was undertaken utilising a blocked randomisation method. Subjects were allocated to either group A and were exposed to current clinical management or group B the experimental micro-current regime. Classification and subsequent evaluation of pathology was assessed employing clinical assessment tests, self-assessment and assessment by diagnostic ultrasound. Subjects were assessed at three; six and twelve month intervals post entry into the study.

Forty-eight subjects (48), twenty-four (24)in each group completed the study. A statistical analysis was performed, calculating the differences between the two groups and between each interval assessment.

Categorical variables were compared between the two groups using the Chi-squared test. The Mann-Whitney test was performed to assess changes in ordinal variables.

Results

Statistically significant differences were found in favour of group B, the experimental group, in four out of the five clinical markers used at the 0.1% level of significance. Baseline characteristics were similar in both groups.

Conclusion

The application of micro-current treatment to the patient presenting with chronic Achilles tendon pathology may make a significant contribution to the clinical management of the condition. Therefore, because from a biological perspective tendons tend to behave in a similar manner, these findings may reasonably extended to treat other tendons presenting with similar pathology.

Four Case Studies: Tendon Pathology/Trauma

Case One

A 23-year-old, Premier League, International Rugby Union player with ruptured Achilles tendon plays Premier level rugby within five months following the injury.

Clinical History

This player had no previous recorded incidence of Achilles tendon problems. In February 2004 he was charging a ball down in a competitive Premier League rugby union game and upon landing spontaneously ruptured his right Achilles tendon. This was repaired surgically using a fibre wire and Vicryl. He was put in a short cast for eight weeks in 45 degrees of plantar flexion. Following this period he was given a brace and at this point he commenced his treatment. The treatment consisted of introducing into the tendon a uniform, cell calibrated micro-current with the duel purpose of mimicking the normal processes of electro-chemical signal transduction and amplifying mitochondria A.T.P synthesis, which has the reported effect to significantly increase tenocyte activity and hence the capacity and level of the regenerative process.

The aim of the treatment was to boost the production of type I collagen and accelerate the process of spatial fibrillar remodelling to reduce healing time and influence the normal and expected prognosis of Achilles tendon rupture in this type of subject.

Intensive physiotherapy was commenced which had as a priority to increase the range of movement in the tibio-talar joint which had been significantly reduced due to the

shortening of the tendon and the length of time the ankle had been fixed in plantar flexion. This was affected to such a degree that a normal walking gait presented a significant problem. Regular musculo-skeletal ultrasound scans demonstrated that the tendon was healing exceptional well and as a result a more robust rehabilitation programme was adopted concentrating upon building the wasted medial gastrocnemius (using MBT boots), proprioception and mobility exercises.

By pre-season in June 2004 the player was gently running again and by mid-August played twenty minutes of a competitive game with no adverse effect. Two weeks and two games later the subject played a full game and has continued to play all scheduled games to this date (November 2004) with no recurrence of any symptoms. In November the player gained his first full international cap eight months following this severe injury.

Case Two

Seven-Year-old racehorse with a 90% severed suspensory ligament goes on to race only seven months after the original injury. This horse suffered a severed suspensory ligament injury probably as a result of a strike injury (one leg striking another) from another horse during a race.

A seven year old, Grade 1 National Hunt horse suffered a severed suspensory ligament to his right front leg. This injury was sustained during a race. He was taken to the Edinburgh Veterinary School where the wound and ligament was sutured. His prognosis was poor and he was not expected to race for a minimum of two years if at all.

Approximately two weeks after the surgery the horse underwent a novel procedure called Tissue Augmentation Cell Transfer Therapy. This technique we have developed where in this instance we flushed the wound with sterile saline solution to harvested some fibroblast cells. These cells were then isolated, transferred to a sterile flask then exposed to a course of low intensity and cell calibrated micro-current treatment. This is done with the purpose of significantly increasing the cell count. Five days later the cells were aseptically 'cleaned' and re-introduced directly into the ligament and wound using a sterile saline solution.

Result

Successful and rapid healing was demonstrated in the ligament and in the wound. It is crucial at this stage for the structure (the ligament in this case) to undergo an aggressive degree of mechanical stress to aid the remodelling phase and also to prevent adhesion developing between the ligament and the surrounding dermal tissue.

The wound appeared on ultrasound scan to be well healed within four weeks of starting this treatment with no sign of infection at any stage or evidence of scarring. The horse was returned to his trainer ten weeks later and pronounced fit to start training again. The trainer and owner were unable to identify which leg had been injured. The horse went on to race again within six months of the time when the original injury occurred.

Subjective Opinion

We believe here that it is worth highlighting the comments of the people connected with the horse but unaware of the treatment protocol that the horse had been exposed to.

Phillip Nelson, owner and bloodstock dealer

'My horse ran at Perth on 23rd April 2003, and finished the race despite having sustained a serious injury to his near fore that proved to be a cut across 90% of his suspensory ligament. He was sent immediately to the equine hospital at Edinburgh, and on 27th May transferred to Kent for treatment and rehabilitation. He returned to his trainer on 24th July in such fine condition that it was impossible to detect the injury. He resumed full training almost immediately, and raced again on 7th December. From injury to return to racing took only 7 1/2 months which is almost beyond belief'.

Mr Michael ‘Mouse’ Morris, Race horse Trainer described the results as 'amazing and unbelievable'

Ciara Gibney MVBMRCVS Vet of O’Byne & Halley, Co. Tipperary.

Reported that, ‘This was a catastrophic injury and from what I have been told I considered that we would be lucky to get the horse back to Ireland. On his return I he was completely sound. I could detect no sign of injury when I scanned him. I was remarkably impressed’

Case Three

A 35 year-old rugby player with a long history of degenerative Achilles tendon pathology ruptures his Achilles tendon and returns to play Premier league rugby within five months.

On May 1st 2004, participating in a Premier League rugby union game this 35-year-old prop forward player 95% ruptured his right Achilles tendon. On May 3rd he was operated employing a technique that plaited the plantaris tendon into the Achilles tendon. There was evidence of a significant degree of degenerative pathology so the two ends of the damaged Achilles tendon were surgically separated prior to the repair.

A two-week period in a short cast was followed by two weeks in an Air Cast boot. Unfortunately, in a rush to answer his mobile phone whilst undergoing some light exercise in the gym, the player burst the stitches and was back in a cast for four weeks. This was 'accident' occurred on the 11th June 2004. Holes were cut in the cast for the purpose dual purpose of being able to apply a micro-current treatment to the tendon and also to apply electrodes so that a muscle stimulator may be used. The micro-current treatment applied to this player was the same as that used for the case one and two.

When the cast was removed the use of the muscle stimulator (Compex) ensured that muscle atrophy was kept to a minimum. Rehabilitation was commenced immediately, which involved mobilising the ankle, working on the tightness of the calf muscles and proprioception exercises. By mid September the player was re-scanned using ultrasound and healing appeared to be progressing at a good rate. At this point the player started jogging. In addition, due to the nature of the pathology it was decided to carry out another two weeks treatment using the same treatment parameters as the original.

On October 4th 2004 the player played twenty minutes of a reserve game and had no adverse reaction. A further period of training and conditioning resulted in the player successfully playing a complete eighty-minute game on October 30th four and a half months after the second injury. To date this player continues to play with no adverse effects.

Case Four

Nine-year-old National Hunt horse severely and almost fatally ruptured its superficial flexor tendon whilst winning a Group 1 race in November 2002. The vet commented that this horse will never race again. November 2004 the horse comes back to race.

This racehorse was reported by the attending vet to have sustained 93% damage to his right fore flexor tendon. Similar to case three, the rugby player, this horse re-injured itself that set it back to square one. The horse struck into itself whilst rolling in his box and all but fully ruptured the tendon that inflamed to such a degree that the overlying skin tore. For a period of 48-hour period the horse could not weight bear on the affected leg and the other front leg was showing signs of stress. However, an heavily improvised air cast support (one used for human casualties in road traffic accidents for fractured tibias) was applied and immediate relief was obtained and the horse then was able to weight bear on the leg.
However, at this stage the tendon was grossly enlarged and the ultrasound scans did not show the presence of any tendon tissue in a 1.5cm section of the tendon. However, despite this the horse did not appear to be overly distressed.

A four-week course of treatment was followed by intensive and structured rehabilitation that followed the remodelling phase of collagen fibrillar alignment. This process was repeated on three separate occasions which resulted in a normally structured tendon. The progress was regularly monitored using diagnostic ultrasound.

One year later with the tendon re-built the horse was ready to return to top grade National Hunt racing and remains sound to this date.

Subjective Opinion

Race Horse Trainer Willie Mullins, former Chairman of the European Trainers Federation, has described the results as unbelievable and this statement is supported by his veterinary surgeon.