Electrotherapy News

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Hi there and welcome to the latest edition of ElectroNews. I have tried to group the papers in this edition so that there is a bit more of an obvious structure – not sure if that will suit people better or not – but will give it a try. This edition includes stuff on ultrasound, a couple on Laser and then various on TENS, Interferential and other electrical stimulation and finally some tissue repair papers to finish off with. Most of the material in this issue are 2006 papers, though there are a couple of others that either I had previously missed or that are important to the theme.

Thanks again to SKF for their continued sponsorship.

I am trying to rewrite the web site - well, restructure it as I have used the same format for a couple of years and a bit of updating might be a good idea. Will try out a couple of different formats and would appreciate it if you would have a look and let me have any feedback with regards whether it works or not - bearing in mind that my web writing skills are a bit limited and time is even more so . . .

Ultrasound Therapy . . . .

Firstly a series of papers relating to various aspects of ultrasound therapy
Two papers relate to bone healing and fracture issues.

A paper that I have not reported before although it is a couple of years old now adds to the debate with regards US and fracture healing : ***Giannini, S. et al. (2004). Low-intensity pulsed ultrasound in the treatment of traumatic hand fracture in an elite athlete. Am J Phys Med Rehabil 83(12): 921-5***.

This is a case report rather than an RCT or other controlled trial but reports in some detail the use of therapeutic US in a case of complex hand fracture in a goalkeeper (current with the World Cup if nothing else). The treatment involved what has now become a bit of a standard 1.5MHz, 0.03 W cm^{-2} for 20 mins a day for 24 days. The player returned to game related activity at 24 days (with tape and modified glove). The X ray results at 2\months indicated complete healing. Clearly it can be argued that the healing in this patient may have happened at this rate anyway, and that there is no way to prove that the ultrasound made a significant difference, but given the clinical norms in

terms of healing rate and the range of complications that many of us will have seen following such fractures, this is an impressive result and makes the intervention well worth considering. The evidence of this case study adds to the other well cited controlled trials (see the US section of the web site and makes for an interesting read for those considering US for fractures.

Chan and colleagues ***[Chan, C. W. et al. (2006). Low intensity pulsed ultrasound accelerated bone remodeling during consolidation stage of distraction osteogenesis J Orthop Res 24(2): 263-70]*** report the outcomes of an animal study in which low dose US (same dose parameters AGAIN) was employed in an distraction osteogenesis animal (rabbit tibia) model. Essentially, the tibia was transected and then taken through a routine distraction sequence with a 1mm a day distraction starting on day 7 post op and continued through to day 21 (6 days distraction out of every 7). Therapeutic US was commenced from the end of the distraction period (metalwork left in place) and was continued for 4 weeks. US dose was the routine 1.5MHz, pulsed 1:4, 0.03 W cm^{-2}, 20 mins a day for the 4 weeks. A separate sample were maintained for a control group. X Rays and computed tomography were used as part of the outcome measures and the tibia were mechanically tested after the 4 week treatment period. 10 animals were included in the treatment and 7 animals in the control group. The bone deficit (gap) created by this procedure was in the order of 17mm. The results included in the paper include bone mineral density data, radiography outcomes and mechanical testing data support the significant effect of the LIPUS treatment group, most especially marked over the early period (mainly in the first 2 weeks), with the differences between the control and treatment groups being non significant at the 4 week point. Whether this means that LIPUS is **only** effective in the early phase post distraction osteogenesis remains to be seen, but certainly this animal\model work supports its use in the early phase.

The next ultrasound paper is pretty hot off the press. Tsai et al **[Tsai, W. C. et al. (2006). Ultrasound stimulation of types I and III collagen expression of tendon cell and upregulation of transforming growth factor beta. J Orthop Res 24(6): 1310-6]** and is more of a lab type study looking at collagen formation in response to US in tendon cells derived from Achilles tendon of the rat. Excised rat TA was sectioned and placed in culture wells kept in appropriate in a medium. Ultrasound was delivered at 1MHz, pulsed 1:4 at various intensities ranging from 0.0 to 1.0 W cm^{-2} (the zero output being the control condition. The US was applied once for 5 mins and the outcomes were determined 24 hours later. A range of outcomes (see paper for details) were used to determine types I and III collagen production and TGFâ concentrations. The amount of types I and III collages extressed by the ultrasound exposed tendon cells was significantly greater than from the control group. The upregulation of TGFâ in the US treated group was also significant, and was a function of increasing US intensity. The importance of collagen (of both types I and III) has been well demonstrated in collagenous repair of musculoskeletal tissues (see Watson 2006 for a recent review, though there are lots of others). This demonstration (albeit in a lab based study) that this process is enhanced by the application of therapeutic ultrasound adds to the evidence to support its use following soft tissue injury. In addition to the supportive collagen extression results demonstrated in this work, the additional demonstration that the US resulted in an increased production of TGFâ further adds to the discussion on how the US can achieve these effects. The discussion in this paper includes some well constructed arguments with regards the non thermal mechanisms of this modality.

The next US paper is a bit more directly clinically relevant, though some might argue that as it is another animal study, it may not directly transfer. It does however (in my opinion) provide some useful insight. Usuba et al **[Usuba, M. Y. et al. (2006). Effect of heat in increasing the range of knee motion after the development of a joint contracture: an experiment with an animal model. Arch Phys Med Rehabil 87(2): 247-53]** looked at two different heating modalities (infra red and ultrasound) and their potential effect with regards range of movement using a knee flexion contracture in a rat model. Essentially knee flexion contractures were induced in 93 adult rate using a ligature system over a 40 day period, looking at mechanical, functional and morphological

changes. The knee was held in 150 degrees of flexion for 40 days, ands following release from the ligature type fixation, plus an additional couple of days to allow the post op inflammatory reaction to subside, animals were allocated to one of three groups (i) stretching without any heat intervention (ii) stretching with infra-red and (iii) stretching with ultrasound. Treatment was applied 3 times a week for 2 weeks. Knee ROM was measured at each treatment session. The details of the interventions are provided in the paper, but essentially, the IRR was applied for 20 minutes duration, the US was applied for 8 minutes at continuous, 1.0 W cm-2 followed by 1.3 W cm-2 pulsed. The US was apparently at 1Hz, though I am pretty sure that they mean 1MHz!! The stretching was identical for all groups and the non contracture knee was a control and received no intervention. Various outcome measures included knee ROM (in vivo but under anaesthesia), viscoelastic joint properties using a previously developed test procedure on dissected limb material. Histological tests were also employed for a sub set of the sacrificed specimens.

Results were obtained for 55 of the animals (far various reasons – identified). There were no statistically significant differences between the IRR and the US groups at the end of the 6 treatment sessions, though both treatment groups had a sig improved ROM compared with the stretch only group. Viscoelastic differences between groups were generally not significant and the histologic analysis showed changes that one might expect in the light of the experimental procedures, and other than some synovial changes in the US group, there was nothing of any significance.

The knees did not return to normal after the 2 week intervention, but that is hardly surprising as the pilot work showed that it took an average of 100 days for the animals to recover from a 40 day immobilisation. Both the IRR and the US interventions, combined with stretch were found to be more effective than stretch alone. There are some interesting issues arising from the study, especially in relation to some of the viscoelastic testing, but the basic results would support the use of a heat therapy in combination with stretch when it comes to treating joint contractures. Whether IRR would be as effective in human studies is questionable in that the relative penetration would be less, and even the US might not be as effective – and so, I guess, we come back to the original question about transferability of findings between animal and real clinical studies.

The last of the ultrasound papers – well, it is nearly ultrasound, but in fact relates to shock wave therapy. There has been a continuous stream of this type of paper over the last couple of years, so I thought that I ought to bring one of the latest ones to you, seeing as it is getting to be a bit popular. Wang et al **[Wang, C. J. et al. (2006). Long-term results of extracorporeal shockwave treatment for plantar fasciitis. Am J Sports Med 34(4): 592-6]**.have produced a paper which is interesting in that it attempts to provide some longer term results rather than the classic short term experiment with limited follow up data. Extracorporeal Shockwawe Therapy has ben investigated for several key musculoskeletal areas, predominantly in the firlds of lateral epicondylitis, supraspinatus tendonitis and plantar fascitis. There are others of course, but these seem to predominate in the recently published literature. The follow up period for this study was for up to 72 months. There were 149 patients in the trial divided into shockwave and control groups. The control group got ‘conventional’ treatment including physical therapy, NSAID’s, orthotics and exercise and sometimes a local steroid injection. The shockwave group were given a limited number of treatment – one usually, but a few got three. There were 79 patients (85 heels) in the shockwave group and 70 patients (83 heels) in the control group.

Patients were evaluated at 60 to 72 months (shockwave group) or 34 to 64 months (control group) with a 100-point scoring system including 70 points for pain and 30 points for function. Before treatment, the groups showed no significant differences in the scores for pain and function. After treatment, the shockwave group showed significantly better pain and function scores as compared with the control group ($p < .001$). The recurrence rate was 11% for the shockwave group versus 55% for the control group which was a significant difference at $p < .001$. The authors conclude that

extracorporeal shockwave treatment is effective and safe for patients with plantar fasciitis, with good long-term results, and based on those results, it is difficult to argue. There are some methodological issues that one might want to pick up on (one being the inequality of follow up periods for the control and treatment groups), but at least it provides some longer term follow up evidence which is often lacking in electrotherapy (and other) clinical trials.

For those who are interested, there are many publications describing shockwave therapy and its uses in musculoskeletal areas. Get on to PubMed and put in 'extracorporeal shockwave therapy' as a search term, and you will come up with over 700 without even trying. Add to that the material available from other databases, and you will have enough to keep you going for a while!!!

Laser Therapy . . . . .

OK, change of subject – lets move into the Laser arena again – but only briefly this time . . . .

There is a very useful systematic review from last year – sure that some of you will have seen it – by Chow and Barnsley [***Chow, R. T. and L. Barnsley (2005). Systematic review of the literature of low-level laser therapy (LLLT) in the management of neck pain. Lasers Surg Med 37(1): 46-52]*** which as you might expect, given the title looks specifically at laser therapy in relation to neck pain. Almost predictably, the final conclusion is that more research and larger RCT's are required BUT it does come to some moderately supportive evidence for the use of laser in both acute and chronic neck pain. If it is not one that you have seen, then well worth a look.

The second laser paper for this issue looks at an area that is starting to buzz a fair bit, and that is the potential for therapeutic laser to stimulate repair in damaged nerve **[*Gigo-Benato, D. et al. (2005). "Phototherapy for enhancing peripheral nerve repair: a review of the literature." Muscle Nerve 31(6): 694-701].*** This is also a review type paper rather than the reporting of a single piece of work, and therefore might make a useful introduction for those that are involved with either nerve work or laser / light therapies. There are almost 70 references included and thus might save somebody a bit of trawling work even if you are not in total agreement with what the authors propose.

TENS and Interferential Therapy . . . . .

OK, I have done a fair bit on laser one way or another in the last couple of issues, so time to move on, and have a look at a couple of Interferential and TENS papers. There was a paper out in 2004 and I am surprised that it hasn't generated much of a debate (or at least not that I have come across) as the findings could be considered a bit radical – certainly from an electrotherapy point of view. Hurley (now at Dublin) et al (from various research groups including Ulster and Brighton) published in Spine – an agreeably eminent journal – ***[Hurley, D. A. et al. (2004). A randomized clinical trial of manipulative therapy and interferential therapy for acute low back pain. Spine 29(20): 2207-16]***. Essentially the aim of the work was to run a multicentered RCT to evaluate the difference between the outcome using IFT and manipulative therapy for patients with acute low back pain. There were three groups – IFT only, manipulative therapy only and a combination group. This was not a small trial – with 240 patients recruited. All received a copy of the Back Book together with manual therapy (80 patients), Back Book plus interferential (another 80) or Back Book plus both manipulative therapy and Interferential (n = 80). Roland Morris Disability

questionnaire was the primary outcome measure and nice design with follow up at 6 and 12 months.

There is plenty of detail in the paper which I would encourage you to get a hold of, but the treatment summary goes something like this . . . . the manual therapy group did not get treated with a prescribed treatment protocol, but the therapist responsible was free to select from mobilisations and or manips as deemed appropriate. The IFT was delivered using a portable device (Omega Inter 4150 (which if you have a look around the web site you will find in the manufacturers section). This was set at 140Hz constant frequency for 30 minutes using a pair of spinal nerve root placed electrodes. The combined therapy group clearly got both interventions.

The range of outcome measures was comprehensive to say the least, using validated techniques. The results are too substantial to list in full here, but the summary data goes like this : patients received on average 5 physiotherapy treatments over 5 weeks (the limits were set as a minimum of 4 and maximum of 10 treatments over 8 weeks). The power calculations are explained fairly comprehensively, and at the end of the day, the power was at least 90% with an alpha of 0.05 – impressive for a multicentered trial of this type. 240 patients recruited with data from 194 of them at discharge, 166 of them at 6 months and from 158 at 12 months.

I have summarised the results below (without all the detail) taken from the abstract – though I promise I have read the whole paper! The groups were balanced at baseline for low back pain and demographic characteristics. At discharge all interventions significantly reduced functional disability (Roland Morris scale) and pain (McGill questionnaire) and increased quality of life (SF-36 Role-Physical) to the same degree and maintained these improvements at 6 and 12 months. No significant differences were found between groups for reported LBP recurrence, work absenteeism, medication consumption, exercise participation, or healthcare use at 12 months ($P > 0.05$).

It was concluded that for acute low back pain, there was no difference between the effects of a combined manipulative therapy and interferential therapy package and either manipulative therapy or interferential therapy alone.

There are a number of points that are up for discussion here, and I am sure that journal clubs and research discussion panels could have some delight with the data. Whatever conclusions people come to, this was a well conducted and carefully constructed trial. It could be argued that these patients might have gotten better whatever therapy was delivered, but it might serve to alert practitioners that electrotherapy is not just a placebo thing, a waste of time or useless, and that even though I would not personally suggest that IFT alone would constitute an ideal intervention, it is interesting that in this case, it was shown to be as effective as manual therapy for the acute back pain group.

Seen any interesting papers?
Is there a paper that you have written
and think ought to be reviewed here?
E mail and let me know
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The second paper in this group is on the use of TENS and exercise for patients with chronic neck pain **[*Chiu, T. T. et al. (2005). A randomized clinical trial of TENS and exercise for patients with chronic neck pain. Clin Rehabil 19(8): 850-60].***

This was a randomised clinical trial comparing the use of TENS at acupuncture points and neck exercise for this patient group. A total of 218 patients were recruited and allocated to either : (a) TENS over the acupuncture points plus infrared irradiation (TENS group); (b) exercise training plus infrared irradiation (exercise group); or (c) infrared irradiation alone (control); twice a week for six weeks.

The main outcome measures were a verbal numeric pain scale, Northwick Park Neck Pain Questionnaire and isometric neck muscle strength which were assessed before treatment, at the end of the six-week treatment, and at the six-month follow-up.

Results demonstrated that after the six-week treatment, significant improvement in the verbal numerical pain scale was found only in the TENS group ($p = 0.027$) and the exercise group ($p < 0.001$). Though significant reduction in Northwick Park Neck Pain Questionnaire score was found in all three groups, post-hoc tests showed that both the TENS and the exercise group produced better improvement than the control group. Significant improvement ($p = < 0.001$ to 0.03) in neck muscle strength was observed in all three groups, however, the improvement in the control group was not clinically significant and it could not be maintained at the six-month follow-up.

The authors conclude that after the six-week treatment, patients in the TENS and exercise group had a better and clinically relevant improvement in disability, isometric neck muscle strength, and pain. All the improvements in the intervention groups were maintained at the six-month follow-up.

As with the previous study, it is difficult to replicate the complexity of the data set in a few paragraphs, but the essential results indicate that TENS (applied to acupuncture points) is an effective intervention, as is exercise. Infra red therapy was not a waste of time, but was certainly less effective than the other interventions.

Electrical Stimulation . . . .

The next set of papers lead on from the IFT and TENS (I already have more of these lined up for the next issue) and look at a couple of emerging issues in other forms of Electrical Stimulation . . . . . .

A paper from 2004 in an American Nursing Journal seems to have passed me by until I cam across it on a recent search. Gaines et al **[*Gaines et al. (2004). The effect of neuromuscular electrical stimulation on arthritis knee pain in older adults with osteoarthritis of the knee. Appl Nurs Res 17(3): 201-6].*** As the authors state, their aim was to examine the short- and long-term effects of a home-based, 12-week neuromuscular electrical stimulation (NMES) of the quadriceps femoris to decrease arthritis knee pain in older adults with osteoarthritis of the knee. Subjects (38) were divided into a group receiving education (arthritis focused) only or education plus NMES intervention. The usual outcome measured for this type of work were employed with the McGill Pain Questionnaire (MPQ) at baseline, during the intervention at weeks 4, 8, 12, and at follow-up and the Arthritis Impact Measurement Scale 2-Pain Subscale (AIMS2-PS) at baseline and week 12. NMES group patients also kept a pain diary completed before and after each stimulation ses-

sion. The stimulation group reported a significant decrease in pain when comparing the pre-post pain scores which was significant, but the overall differences between group changes were not significant. Hence leading the authors to the conclusion that the NMES was effective as a mode of pain relief in the short term, but that it did not make a significant longer term difference.

The stimulator used was a portable battery powered device which delivered symmetric biphasic rectangular pulses at 50Hz, using a 10 second stim followed by a 50 second rest in order to minimise fatigue, and included a ramp up of 3 seconds. Self adhesive electrodes were placed proximally on V Lateralis and distally over the VMO fibres and patients were supposed to use the device for 15 minutes a day, three days a week for the 12 week trial period. The intensity used followed a detailed protocol (identified in the publication) based on % MVC activity.

The two groups were comparable in terms of their progress by the end of the 12 weeks, although, as identified above, there were session based pain changes for the NMES group. Adding the NMES to the education seems to have had no significant impact on the longer term change. One might question the waveform and the frequency applied compared with other trails that have demonstrated benefit – including some previous identified in this publication. That is not a matter of trying to make excuses for a therapy that doesn't work – just an observation! It is likely that the immediate benefit of the stimulation was a TENS like pain gate or opioid mediated relief (the authors make the same point), and that if relief of symptoms was intended, I would have thought that a variation of the stim parameters to focus on the motor rather than the sensory effect would be the next option.

A 2006 publication concerning the effect of electrical stimulation on neuromuscular adaptation makes for an interesting read. **[*Maffiuletti, N. A. et al. (2006). Neuromuscular adaptations to electrostimulation resistance training. Am J Phys Med Rehabil 85(2): 167-75].***

The authors identified some of the controversies with regards the effects of EStim on strength and muscle function changes previously identified in the literature and set out to explore how some of these changes might be brought about. They considered central adaptations in addition to local fibre changes which would help to settle some of the debate running.

The study set out to look at neural and muscular adaptations to a 4 week stimulation protocol of the quads in a single case study design. In vitro and in vivo tests were completed both before and after the stimulation looking at whole muscle activity, fibre contractile properties and fibre type changes.

In summary, the results show that the increase in maximal voluntary strength (+12%) was accompanied by neural (cross-education effect and increased muscle activation) and muscle adaptations (impairment of whole-muscle contractile properties). Significant changes in myosin heavy chain (MHC) isoforms relative content (+22% for MHC-2A and -28% for MHC-2X), single-fiber cross-sectional area (+27% for type 1 and +6% for type 2A muscle fibers), and specific tension of type 1 (+67%) but not type 2A fibers were also observed after training.

It was suggested that plastic changes in neural control confirm the possible involvement of both spinal and supraspinal structures to electrically evoked contractions. Changes at the single muscle fibre level induced by E Stim were significant and preferentially affected slow, type 1 fibers.

The EStim was applied 4-5 times a week whilst seated on a leg extension machine which provided resistance during the stimulation. The device employed was a portable stimulator with electrodes attached over V Lateralis and V Medialis and a common electrode places at the lower end of the femoral triangle. The stim was set at 75Hz, biphasic symmetrical rectangular pulses of 400 micro-

seconds duration. The duty cycle was at 24% made up of 1.5 sec ramp up, 4 sec stable, 0.75 sec ramp down and then 20 seconds rest. The session was for 20 minutes (incl warm up) and a total for 40 contraction cycles was achieved in that period. More details are provided in the appropriate section of the paper.

The weaker set of quads were used as the stim side, and the initial weakness was reversed such that they were the stronger side at the end of treatment (24% weaker pre Rx and 3% stronger post Rx) and the cross sectional area analysis of different fibre types showed an increase for both types 1 and 2A which was significant, with the type 1 fibres demonstrating the larger effect (which I found to be a surprising result given the stim parameters – would have expected a larger type 2 fibre response – hey ho).

There are other results detailed, and those of you into muscle physiology changes in response to electrical stimulation should find it interesting. The discussion with regards central versus peripheral changes and possible mechanisms for them also makes for an insightful discussion.

The second E Stim paper looks at the use of Botox and electrical stimulation in dropped foot post stroke [***Bayram, S. et al. (2006). Low-dose botulinum toxin with short-term electrical stimulation in poststroke spastic drop foot: a preliminary study. Am J Phys Med Rehabil 85(1): 75-81].***

The aim of the work was to compare low-dose botulinum toxin injections followed by short-term electrical stimulation with high-dose botulinum toxin for poststroke spastic drop foot.

Twelve patients with spastic drop foot were randomly assigned to two treatment groups. The first group (n = 6) received low-dose (100 units) botulinum toxin injection to the posterior tibial muscle in combination with short-term electrical stimulation, and the second group (n = 6) received a total of 400 units of botulinum toxin injections in equal doses to the posterior tibial, soleus, medial, and lateral gastrocnemius muscles.

The patients were evaluated before and 2, 4, 8, and 12 wks after the treatment by the following variables: resting position angle, active and passive ankle range of motion, Modified Ashworth Scale, time walking 10 m, clonus score, Brace Wear Scale, and Global Assessment of Spasticity Scale.

The results showed improvement in both groups for all variables except brace wear. No significant difference was found between the study groups after treatment. The effects lasted shorter in the first group, whereas more side effects were seen in the second group.

The authors conclude that there was no significant difference between the group outcomes, and it could be argued therefore that the combination treatment provided the same effects (though they did not appear to last as long) as the high dose group, but with less side effects. Conversely of course, it could be argued that there is no point using thee Stim component, when the same result can be achieved with a higher dose of BoTox – and just live with the side effects – have a read and see what you come up with!

The last of the electrical stimulation papers this time around relates to a Cochrane review paper on Electrotherapy for mechanical neck disorders. I have linked it to the E Stim section, although it does consider a range of interventions **[*Kroeling, P., A. Gross, et al. (2005). Electrotherapy for neck disorders. Cochrane Database Syst Rev(2): CD004251].***

The review aimed to assess whether electrotherapy, either alone or in combination with other treatments, relieves pain, or improves function/disability, patient satisfaction, and global perceived effect in adults with mechanical neck disorders (MND). The usual Cochrane type methodology was employed (described in detail) and on which I have commented previously.

Fourteen comparisons (525 people with MND), in 11 publications, were included in the review. The analysis was limited by underpowered low quality trials, paucity of literature, and heterogeneity of treatment subtypes (nothing new there then!).

The results for the electrotherapy subtypes included limited evidence of benefit for low or high frequency pulsed electromagnetic field (PEMF) compared to placebo, provides immediate post treatment pain relief only for chronic MND and acute whiplash.

The authors conclude that they were unable to make any definitive statements on electrotherapy for MND. The current evidence on Galvanic current (direct or pulsed), iontophoresis, TENS, EMS, PEMF and permanent magnets is either lacking, limited, or conflicting, and the almost inevitable final statement that possible new trials on these interventions should have larger patient samples and include more precise standardization and description of all treatment characteristics.

Tissue repair . . . . .

The final section this time reports some papers that relate to tissue repair and healing.

If you have been through any of the previous editions of the ElectroNews, you will have come across numerous mentions of TA repair and also something of the debate with regards the TA microcirculation. A paper from earlier this year **[*Knobloch, K, et al. (2006). Achilles tendon and paratendon microcirculation in midportion and insertional tendinopathy in athletes. Am J Sports Med 34(1): 92-7]*** reports on some experimental work that aimed to assess the microcirculation of the TA and paratendon in both healthy volunteers or athletes with midportion or insertional tendinopathy.

Parameters of Achilles tendon and paratendon microcirculation (such as tissue oxygen saturation, relative postcapillary venous filling pressures, and microcirculatory blood flow) were determined at rest at 2-mm and 8-mm tissue depths in 66 physically active volunteers. Patients were divided into three groups : Healthy TA's (n=41), current insertional TA problems (n=14) and current midportion TA pain (n=11).

The TA diameter 2 cm and 6 cm proximal to the insertion was increased in symptomatic tendons. The data for the 2cm proximal tests were not significant though for the 5cm proximal, they were ($p<0.05$). Compared with the uninvolved opposite tendon, deep microcirculatory blood flow was significantly elevated at insertional ($P <.05$) as well as in midportion tendinopathy ($P <.05$).

The circulatory parameters for the uninvolved TS of the tendinopathy groups were not significantly different from the normal healthy athlete group data nor was there any significant differences in the microcirculatory parameters for opposite limbs of the healthy athletes.

Insertional paratendon deep microcirculatory flow was elevated in all groups, whereas tissue oxygen saturation and relative postcapillary venous filling pressures were not significantly different.

It as concluded that microcirculatory blood flow is significantly elevated at the point of pain in insertional and midportion tendinopathy. Postcapillary venous filling pressures are increased at both

the midportion Achilles tendon and the midportion paratendon, whereas tissue oxygen saturation is not different among the studied groups. No evidence was found of an abnormal microcirculation of the asymptomatic limb in Achilles tendinopathy.

It looks like the TA pathology argument, and certainly the TA microcirculation debate has yet to be resolved. The authors of this paper also make some interesting remarks with regards eccentric exercise training as an intervention for these patient groups.

Achilles tendon again – but back to our old chums, the rats, in a paper this year looking at the effect of substance P on tendon biomechanics. [***Steyaert, A. E. et al. (2006). The effects of substance P on the biomechanic properties of ruptured rat Achilles' tendon. Arch Phys Med Rehabil 87(2): 254-8].***

Substance P was injected into the paratendinous region of a ruptured and subsequently sutured rat Achilles' tendon in 96 rats (day 2 – day 6)

In brief, it was found that injection of substance P improved tendon healing by enhancing stress at maximal load and work to maximal load although tendon stiffness was not significantly affected.

The reason for including this is an area of interest I have had for some time, We know that substance P is released from the sensory nerve as a part of the neurogenic inflammatory response, and if the substance P has a beneficial role in tendon healing, there may be some options for deliberately invoking this reaction post injury / surgical repair, and also possible that the use of antidromic electrical stimulation could be an effective way of getting there. Let me know if you are interested in following this up – could make for an interesting study.

Last one for this issue . . . and where would we be without an NSAID paper??? In fact I have a REALLY peachy one for next time, but it is VERY hot off the press, and I can't make this newsletter any longer than it is already.

Anyway, Persson et al in Sweeden **[*Persson, P. E. et al. (2005). Do non-steroidal anti-inflammatory drugs cause endoprosthetic loosening? A 10-year follow-up of a randomized trial on ibuprofen for prevention of heterotopic ossification after hip arthroplasty. Acta Orthop 76(6): 735-40]*** have reported on a 10 year follow up study of 140 or so patients who had been involved in a previous study of theirs. Their rationale was that if NSAID's do inhibit new bone formation, then there might be a significant link between NSAID drug use and endoprosthetic loosening (the authors identify the key elements of the issue somewhat more eloquently than me!)

142 patients were followed up, of whom, 96 patients were treated with ibuprofen (48 for 1 week postoperatively, 48 for 2 weeks postoperatively) and 48 patients were not treated (I know it does not add up to 142, but these were the numbers from the original trial).

13 patients had been revised. All revisions except 1 belonged to groups treated with ibuprofen and the calculated 10-year risk for revision was thus significantly higher in the ibuprofen-treated patients ($p = 0.05$).

Eleven of the revisions occurred due to fractures of the femur (2) or aseptic loosening (9), reasons that the authors argue can be attributed to negative effects of ibuprofen. In addition to the revised patients, 94 other patients were alive at the 10-year follow-up and 84 underwent radiographic examination. 9 loose prostheses were found radiographically, but these were equally distributed between ibuprofen-treated and untreated hips.

It was concluded that the high proportion of revisions in the ibuprofen groups, in combination with clinical and experimental evidence of inhibitory effects on new bone formation of NSAIDs, warrants further investigation of the effects of these drugs on prosthetic fixation.

Ummmmmmm, food for thought there I think.

OK, that is enough for now. There are papers already lined up for the next edition which included a paper by Warden on ultrasound and non steroidal inflammatories, one on electrical stim and denervated muscle – something about which I seem to get a continuous stream of enquiries, several on clinical electrical stimulation trials, ice and pulsed shortwave, ultrasound and fracture healing (again) and others. If you have come across papers that you think deserve a mention and I seem to have missed them, by all means let me know and I'll do my best.

Next issue expected in September sometime, so in the meantime, have a good Summer (if you are in the northern half anyway) and a good Winter if you live down south!

As ever, I look forward to your comments, requests for material / topics to cover in the next one and any suggestions for papers that I appear to have missed.

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I will put a copy of this onto the website if you want to direct anybody else to it (will be linked from the download pages) and if you want a hard copy, it might be easier to print from there.

Regards

Tim