The effect of pulsating magnetic fields on the cancer process

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Abstract - A randomised double-blind crossover trial was carried out using 5 pairs of cancer patients treated for 8 weeks with an active pulsating magnetic field (PMF) device and 8 weeks on a placebo. The trial was to test the hypothesis that PMFs of special frequencies, particularly Extremely Low Frequencies (ELF: 3Hz – 300Hz), affect human cells in cancer patients in a way that improves their metabolism, thereby helping to reverse the cancer process or milieu. Several factors claimed to be characteristic of cancer progression were monitored during the eight weeks of active treatment and again during the eight weeks of placebo. Results showed that, using three of the four monitoring methods, there were small positive changes observed in the group receiving active treatment relative to their response with the placebo. There was also some evidence of a slowing down of the cancer process and a delayed positive effect in T-Lymphocyte Viability count (increase) and in Gastro-Intestinal Stress (decrease). Using the fourth method a consistent improvement was observed in cell metabolism, allergic response, peripheral and central nervous system and pericardium circulation. These results throw some light on the factors that might be important in reversing the cancer process and suggest ways of improving protocols and monitoring changes for future trials.

Introduction

For many years controversy has surrounded the hypothesis of what cancer is. The current paradigm sees cancer as a process that starts locally, sometimes recurring locally, later spreads regionally and, in its final stages, metastasises to a remote site. An alternative paradigm sees cancer as a degenerative disease with many contributory factors, including psychological ones, with the tumour seen as a late-stage symptom of the systemic breakdown of the body's cell metabolism and possibly also of the body's immune system[1].

Evidence from randomised trials has suggested that surgery has no effect on survival or mortality [2-4], radiotherapy possibly does more harm than good[5-7] and chemotherapy produces serious side effects with only limited benefits in one or perhaps two types of cancer[8]. The harmful effects of radiotherapy and chemotherapy have been significantly understated with up to 20% of all deaths among cancer patients attributed to the treatment itself[9]. Viewed overall, cancer treatment based on the current paradigm is seen as a qualified failure[10], with even the claimed benefits in percentage five-year survival due to earlier detection[10] seen as spurious[2,3,11]. Despite this situation, most cancer research remains locked into the current paradigm with little to show for the past 50 years of research.

Against this background there is therefore a need to shed more light on the cancer process and investigate whether the alternative paradigm is closer to the truth. For this purpose it is necessary to develop methods of measuring the effects, if any, of systemic therapies on the cancer process with a view to identifying what that process might be.

One systemic therapy that has been shown in four randomised trials to have a significant effect on survival and mortality is behaviour therapy, a particular type of structured psychotherapy[12-16]. (Other trials using unstructured psychotherapy or psychological counselling showed no benefits, suggesting that the type of psychotherapy and the skill of the therapist was critical to the success[16].)

However the trials showing the largest benefits in terms of survival and quality of life, though involving only 6 weeks of therapy, required several years for the benefits to be observed. In only two of these trials[12,14-15], of the possible systemic body processes involved, only the immune system was monitored to identify the particular mechanism that had accompanied the slowed down or reversed cancer process. A second systemic therapy was therefore sought that could be applied objectively and effects observed in the short term.

Another systemic therapy used, the Gerson Diet, developed by German doctor Max Gerson is based on the principle that people with cancer have a breakdown in cell metabolism resulting from excessive sodium and insufficient potassium in the diet. According to this hypothesis a diet rich in potassium could reverse the cancer process[17]. Unbeknown to Gerson, Herbert Ling had questioned the validity of the Sodium-Potassium pump and proposed a new hypothesis involving structured water to explain the retention of cell membrane potential and the ability of cells to retain a surplus of potassium inside the cell despite the high sodium (saline) throughput. This hypothesis was later validated using Nuclear Magnetic Resonance and Freeman Cope applied it to cell damage in cancer. According to Cope cell damage should be reversible and normal metabolism restored as long as it was not too far advanced[18]. Trials of the Gerson Diet have not replicated the results originally obtained by Gerson in reversing the cancer process. For this reason a therapy that is claimed to restore cell metabolism might offer one suitable approach.

Three randomised double-blind placebo controlled trials have demonstrated the efficacy of ELF pulsed electromagnetic fields in reducing pain in osteoarthritis and persistent rotator cuff tendonitis[19-21]. Research (by G Fischer in the Dept of Biology at the University of Graz in Austria, HL Koning in the Dept of Electrophysics at the University of Munich and U Warnke in the Dept of Biomedicine and Biology at the University of Saarbruken in Germany, and SD Jovanic in the Dept of Electrophysics at the University of Belgrade in Yugoslavia) has suggested that the PMF mechanism is systemic and affects cellular metabolism. In particular it suggests that such fields

- help to restore the cell membrane potential[22] that is depressed in people with degenerative disease;
- increase the partial pressure of oxygen and the perfusion of oxygen into cells, thus tending to reverse the anaerobic process whereby cancer cells grow;
- affect the calcium cascade process in cells;
- activate enzymes and free radical scavengers;
- help to regenerate and restructure cells[23].

Each of these factors is claimed to affect the absorption of nutrients into the cell and the elimination of the cell's waste products and possibly also affect the immune system. Such effects are claimed to be observable in the blood of cancer patients immediately after PMF treatment, although no long-term benefits have been demonstrated. Tens of thousands of people have been treated with ELF PMFs for a wide variety of conditions with many anecdotal reports of positive results[24]. Similarly many practitioners have used such devices on cancer patients and have reported positive results, even with terminal cancer patients[25].

The role of the immune system in controlling cancer has never been established[26] although several articles have assumed that a cancer surveillance system exists that keeps cancer cells in check at their formative stages[27]. Surgery, radiotherapy and chemotherapy have all been found to suppress the immune system[5,28]. Recent research has provided some light on this subject but suggests that evidence for the role of the immune system remains confined to cancers of viral origin[29]. In contrast to this it is claimed that Immuno-Augmentative Therapy has produced 15% 5-year survivals with late-stage cancer patients, with even higher survival values for selected types of cancer[30]. This therapy is based on injecting three of the natural immunoglobulins at specified levels to restore the natural immune response. Those who respond are claimed to show evidence of this within six weeks with benefit including both tumour shrinkage and increased survival.

However if the immune system is affected by such fields this would not explain the benefits observed with other conditions apparently not involving the immune system. This would suggest that effects on the immune system are secondary to benefits to another more fundamental process such as cell metabolism.

The purpose of the present trial is to test the hypothesis that pulsating magnetic fields affect cells and, if possible, identify the organs affected and, if possible, identify the mechanism for the action of the fields.

Four factors were measured to identify the types of change involved:

1. Immune response, measured by means of the T-Lymphocyte Viability Count;
2. disease progression as shown by the Bolan's Clot Retraction Test[31]. This test identifies systemic effects of metabolic dysfunction caused mainly by Reactive Oxygen Toxic Species (ROTS) which include the free radicals and hydrogen peroxide. The test measures Oxidative Stress overall as a measure of stage of cancer progression; and includes a measurement of acute stress to the lymph system and central organs (particularly the gastro-intestinal tract).
3. blood circulation efficiency. This was in the form of monitoring changes in the blood volume being pumped, blood pressure in peripheral circulation, blood viscosity and the amount of oxygen being transferred from the blood to the peripheral tissues. These four factors were measured by means of **N**ear-**I**nfrared **R**ed **P**hotoplethysmography (NIRP) using a **C**omputerised diagnostic device for measuring **M**icro- and **M**acrovascular **D**ynamic perfusion (CMMD)[32,33].
4. skin resistance at selected acupuncture points. This was Electro-Dermal Screening Testing (EDST) in the form of a **L**ife **I**nformation **S**ystem **TEN** (LISTEN Machine)[34]. This is based on the hypothesis that various acupuncture points relate to different organs or organ systems. When an organ is unhealthy the skin resistance of the relevant acupuncture point changes, up or down, from the typical value of 100 kilo-ohms.

Method

Ten cancer patients were randomised into two groups, a treatment group and a placebo group. Half were treated with a PMF device for 8 weeks after which there was a Crossover with the treatment and placebo groups reversed. T-Lymphocyte Viability Test and Clot Retraction Tests were carried out and CMMD readings and LISTEN readings were measured in all participants before and after the first 8-week period and again after the second 8-week period. Both the practitioner and patient recorded symptoms during the sixteen weeks of the trial. Records were kept of any special treatments undergone during the trial.

The protocols

Test protocols were based on those developed by Dr Hannalore Bilz from the …….. who has treated many cancer patients. The control box for the device has 10 settings with increasing magnetic field intensity. The protocol consisted of three 8-minute sessions each day (morning, mid-day and evening) starting with setting 3 in the morning, 3 at mid-day and 1 in the evening. From the second week they were increased to settings 4,3,1 and in subsequent weeks to 5,4,2; 6,5,2; 7,6,3; 8,7,4; 9,8,5 and finally 10,9,6 for week 8. The same rising settings were used for the second 8 week period after the active and placebo devices were swapped.

The device

The device used was a Quantronic Resonance System (QRS) consisting of a control box with 10 settings connected to a "mat" approximately 1m x 2m on which the participant lies. The mat has a single coil that is bent backwards and forwards around the complete area so as to generate a stronger magnetic field under the legs and a gradually decreasing field up the body with the weakest field under the head and neck. The patient lies on the mat for the eight minutes. Once the setting is selected and the ON button pushed the control box generates a cycling saw-tooth waveform that reverses every 2 minutes and switches off at the end of 8 minutes. The magnetic field waveform

incorporates a range of frequencies between 0.1Hz and 1000Hz, especially 3, 23 and 200 Hz at a maximum field intensity from 0.15 microtesla at setting 1 to 15 microtesla at setting 10.

The five placebo devices were normal ones whose control boxes had been modified by the manufacturer so as to generate no current and therefore no magnetic fields into the mats. All lights were illuminated and fluctuated in the usual way as if the device were active. The 10 devices were provided to the Trial Leader in pairs, one active and one placebo.

The 10 participants were divided into five pairs, one to receive the active device for the first 8 weeks and the other the placebo. The first participant in each pair was asked to pick one of the devices. The second device was used by the second member of the pair.

The participants

The 10 participants included 3 with breast cancer, 1 with bowel cancer, 1 with lung cancer, 1 with medullary carcinoma of the neck, 1 with melanoma, 1 with nasopharyngeal cancer, 1 with Non-Hodgkin's Lymphoma and 1 with squamous cell carcinoma of the maxillary sinus.

The tests

The T-Lymphocyte Viability Test was carried out in the normal way by drawing a blood sample.

The Bolan's Blood Clot Retraction Test involves producing a drop of blood at the fingertip using a pinprick and touching it several times onto a slide. After drying the slide is viewed under a Dark-Field Microscope. The appearance of the drop, particularly of the fibrin net, is claimed to give a measure of the progress of degenerative disease, including cancer. If the blood were affected by the ELF PMFs during the 8 weeks of treatment, it would show up rapidly on such a test.

The Blood Circulation Test using the CMMD has been claimed to show rapid changes in the blood circulation of patients with degenerative disease, including cancer. However, as mentioned above, the only evidence of longer term effects are anecdotal. Information about characteristics of the vascular system is obtained from the shape of the blood pulse, particularly the relative height and position in time of the dicrote, ie the portion of the pulse wave shape due to the second expansion of the artery. The pulse profile was measured using Near Infrared Red Photoplethysmography. This involved strapping the sensing diodes to the fingertip of the participant. After several minutes of relaxation and the stability of the temperature and pulse were confirmed, the computerised readings were taken and integrated over a 70 second period, stored if satisfactory and blood characteristics calculated.

Eight different parameters were derived from the pulse shape, in particular the size and position of the dicrote. Four of these relate to the microvascular system and four to the arterial (macrovascular) system. The relative changes in these parameters in relation to the normal range gives some indication of improvement or deterioration of the arterial system or its parts.

For Electro-Dermal Screening Testing (EDST) the ohm meter used to measure the skin resistance is designed to deliver approximately 10-12 microamperes of direct electrical current at 1-1.25 volts. It is calibrated to read from 0 to 100 such that the standard skin resistance of 100 kilo-ohms reads 50. If the reading is below the optimum value of 50 it represents degenerative disease; if above the optimum it represents an acute condition such as inflammation.

There were about 22 readings taken on each person out of the 54 commonly used, each corresponding to an acupuncture point related to a particular organ or organ system. The 22 points chosen were those considered relevant for people with cancer.

A person in perfect health would measure 50 on all 22 readings. Efficacy of treatment would be indicated by a reduction in the departure from 50 on most of the readings. For large reductions the points that contributed most to the improvement could be identified.

Results

During the course of the trial one patient died (breast cancer) and a second (NH Lymphoma) withdrew to travel overseas. For this reason the results of only 8 participants were available. A second participant, (nasopharyngeal cancer) died 5 months after the trial ended and a third (lung cancer) died 12 months after the trial.

1. T-Lymphocyte Viability

Table 1 shows the results of the T-Lymphocyte Viability Tests and Figure 1 shows this information in graphical form.

In Table 1 and Figure 1 increasing TLV Count towards 100% represents improved immune status. Changes of more than about 10% over a period of 8 weeks would be unexpected, unless a particularly immune suppressing therapy were undergone during this period. As can be seen from Figure 1, patient 4y experienced such an effect (fall of 27%) following surgery to remove a melanoma in the shoulder and patient 5x experienced a similar effect (fall of 14%) following a course of chemotherapy received during weeks 14-18.

For cancer patients, if the state of the immune system is a measure of the ability of the body to control cancer growth, or if the onset of cancer compromises an already weakened immune system, a gradual fall of a few percentage points would be expected over an 8-week period. A significant increase would be unexpected during such a short period. A slight increase might be expected if a cancer patient were undergoing a therapy that was controlling his/her cancer process or strengthening cell metabolism. As all of the patients were undergoing some long-term alternative cancer therapies at the time, a slight increase would therefore not be unexpected.

Of the 8 patients for whom readings were available five experienced a gradual fall in the TLV count over the first 8 weeks, irrespective of whether they were receiving active treatment or placebo. The other three experienced an increase, 2 with an active device and one with a placebo. Only in one case (4y) was the effect significant (viz a 13% increase). However this occurred over a short period of about 4 weeks of active treatment and is therefore unlikely to be attributable completely to the active treatment. This was followed by a very large drop, from 82% to 55% as measured on 2 February which could be attributed to the fact that the patient underwent surgery on 22 January. There is evidence that surgery can suppress the immune system[28].

During the second 8-week period five patients experienced an increase in TLV Count, including one on active treatment (4x) and four on placebo.

Three of the four who received active treatment during the first eight weeks experienced an increase during the second eight weeks on the placebo, whereas only one of the four who received placebo during the first 8 weeks experienced an increase during the second 8 weeks on active treatment. This suggests a possible delayed response from active treatment.

Overall Effect

Two of the participants (1 active and 1 placebo) did not have tests at the end of the trial. For purposes of comparison their readings were therefore assumed to be unchanged from those at

Crossover. The average count of the 8 patients was about 78% at the beginning of the trial, about 73% halfway through the trial at crossover, and about 78% at the end.

It might be concluded from this that the effect of treatment was to slow down the gradual fall in TLC Count over the 16-week period, possibly with some delayed effect that could explain the increased count in several patients receiving placebo following 8 weeks of active treatment.

2. Clot Retraction Test

(a) Progression Stage as measured by Oxidative Stress

Table 2 shows the results of the Progression Stage as measured via the Clot Retraction Test and Figure 2 shows this information in graphical form.

In Table 2 and Figure 2 values represent the stage of progression, from Stage 1, representing earlier tumour progression to Stage 4 representing late stage progression. Stages are one of 8, starting with ½ and progressing in halves to 4. A Stage assessed as being 2-2½ is recorded as 2.25.

Cancer patients would be expected to be progressing slowly through the stages towards Stage 4. Any reversal in this progression would be unexpected unless the progression were a temporary phenomenon resulting from acute effects of a treatment, in the same way that the TLV count might be suppressed following a harmful treatment and recover soon after.

For the 7 cancer patients for whom measurements were available 6 showed an increase in staging over the first eight weeks and 1 (2y) showed a slight fall. Increasing stage was observed with 3 active and 3 placebo treatments. The falling stage was with an active device.

During the second eight weeks a reduction in stage was observed in 3 of the 4 patients receiving active treatment (2x, 4x, and 5x) and increased staging occurred in 3 out of the 3 on placebo. This suggests that, unlike the TLV case, there is no delay in effect. Although the reduction in staging for 2y stopped and perhaps reversed during placebo the change was too small to be significant.

Overall effect

The average stage of the 7 patients initially was 1.4. At crossover it was 2.2. At the end of the 16 weeks it was 2.1, suggesting a possible slowing down of disease progression.

(b) Lymph Stress Test

Table 3 shows the results of acute Lymph-system stress as measured by the Clot Reaction Test. This is indicative of a compromised immune system and toxins being inadequately drained from the system. Figure 3 shows this information in graphical form.

The test differentiates between the lymph systems on the left and right hand side of the body. The values in the Table are averages of the values assessed for the two sides.

Increasing values in Table 3 and Figure 3 represent deterioration of the lymph system. With cancer patients this deterioration would be expected due to the inefficiency of the detoxification processes.

Of the 7 patients for whom values were available 4 showed a deteriorating lymph system during the first eight weeks (2 on active, 2 on placebo), 2 had a stable system (1 active, 1 placebo) and 1 was improving slightly (active). During the second eight weeks 3 were deteriorating (all placebo) and 4 were improving (3 active, 1 placebo). If the treatment was affecting these values the improvement was not delayed, similar to the Stage progression results.

Overall Effect

Average value of Lymph-System Stress at the beginning of the trial was 1.07, at Crossover it was 1.36 and at the end of the trial it had fallen back (improved) slightly to 1.21, again suggesting a possible slowing down of disease progression.

(c) Gastro-Intestinal Tract

Table 4 shows the results of acute oxidative stress of the central organs, particularly the Gastro-Intestinal Tract as measured by the Clot Reaction Test. Figure 4 shows this information in graphical form.

As with Lymph-System Stress this test differentiates between the organs on the left and right hand side of the body. The values in the Table and Figure are averages of the values assessed for the two sides.

Increasing values in Table 3 and Figure 3 represent deterioration of the central organ system. With cancer patients this deterioration would be expected due to the inefficiency of the digestion and detoxification processes.

Of the 7 patients for whom values were available 4 (2 active, 2 placebo) showed a deteriorating GIT during the first 8 week period, 2 (1 active, 1 placebo) showed a slightly improving GIT and 1 (active) was stable. During the second 8 week period 4 (2 active, 2 placebo) were improving, 1 (active) was deteriorating and 2 (both placebo) were stable. As 2 of the 4 who improved during the second 8-week period were on placebo this is suggests the possibility of some delayed effect. There was a reduction in the number of those with a deteriorating GIT from 4 to 1.

Overall effect
The average stage of the 7 patients was initially 1.14. At Crossover it was 2.0. At the end of the 16 weeks it had fallen to 1.21, again suggesting a possible slowing down of disease progression.

3. Blood circulation/vascular system (NIRP/CMMD)

In relation to the eight main parameters derived from the measurements

- There were no abnormal rates observed
- There were differences between readings of those on QRS therapy when compared with those on placebo, but not highly significant

(inclusion subject to satisfactory links to measured data:)

Some changes were observed in one parameter derived from these, viz fibre stretching, that suggested that the protocols requiring all participants to undergo the same increasing magnetic field intensities over the 8-week schedule limits the efficacy of the treatment.

Fibre stretching (FS) refers to the stretching of elastic fibres of (arterial) blood vessels, including intima (the inner layer of a blood vessel, comprising an endothelial monolayer on the luminal face with a subcellular elastic extracellular matrix containing a few smooth muscle cells) where

- an increase in fibre stretching FS means an increased stretching and therefore an increase in peripheral resistance.
- a reduction in FS is a decrease in blood vessel wall stretching (elastic fibres, intima) which can produce a better "cooperation" of the heart and periphery in the cardiovascular system. Too strong a reduction can lead to a "maladjustment".
- the normal range in FS is 0.94……..1.06

These elastic fibres lie immediately above the vessel endothelium, which decisively influences the vascular function and structure (release of vaso-active substances - eg nitrogen monoxide, and vaso-constrictive opponents - eg thromboxane, free radicals and endotheline)

As a general rule a higher QRS level increases the fibre stretching FS. Figure 5 shows the relationship between fibre stretching FS and vessel tonus (muscle tone) in a 50-year-old normal trial participant. Levels 2 and 4 show a similar rate within the normal range, whereas Level 6 produces a highly increased fibre stretching. From the measurements it was found that

- Generally the participants have a vascular tonus at the low level of the normal range, as expected for those with cancer
- 45% of measurements reached the normal range, so it can be concluded that the selected QRS level was the correct one
- 33% partly showed an acute increase with the selected QRS level (level selected too high) while
- 22% of rates always stayed in the normal range, even with placebo.

From this is can be concluded that for optimal treatment of cancer patients using PMF therapy the magnetic field settings should be determined on an individual basis to ensure that the fibre stretching remains in the normal range.

The settings chosen for the trial were based on a protocol suggested for cancer patients.

4. Electro-Dermal Screening Testing (Listen machine)

Table 6a shows the raw data from this screening test for one of the participants (3x).

One way of interpreting the measurements is to
1. convert all readings R_n to a value $X_n = (50 - R_n)$ and ignore negative values
2. add up all the vales of X_n viz $\Sigma[X_n]$
3. take an average of all the difference readings, $\Sigma[X_n]/n$.

If an overall positive effect is observed it is then possible to identify those particular organs or organ systems that contributed most to the improvement.

Consider the measured values in Table 6a for participant 3x.

The average value of the 22 readings Rn for this participant was 42.1 before treatment with pulsed magnetic field therapy and 44.5 afterwards. This is a change of only 6%. However the reduction of the differences from 50, from an average of 8.0 to 5.5 is a reduction of 31%. The corresponding change during placebo was from 5.5 to 6.0, an increase of 9%, a gradual worsening expected with a cancer patient.

The averages of the differences, Ave[Xn], before the trial, at Crossover, and at the end of the trial were then used to plot changes for each participant. Results are shown in Table 6b. These are summarised in Table 6c and shown in graphical form in Figure 6.

These results were complicated by the fact that only 3 (3x, 4x and 5y) of the 8 patients for whom values were available had all three readings taken. Of the other 5,

- one (2x) had no readings taken prior to the start of the trial. This omitted reading was therefore taken to be the same as at Crossover, ie assuming no change during placebo treatment;
- one (1x) had no final reading taken. This omitted reading was therefore taken to be the same as at Crossover, ie assuming no change during active treatment;
- one (2y) had no reading taken at Crossover, the second reading taken midway through the second 8-week period, and no reading taken at the end of the trial. An extrapolated reading was

therefore recorded for Crossover and the second reading was taken as the final reading, ie assuming no further change during placebo treatment;

- two (4y and 5x) had no readings take at Crossover. Extrapolated readings were therefore recorded for Crossover. The delay in the final reading for 5x (and for 4x) was ignored.

These five special readings are shown in the Table with a speckled background.

With these reservations, the average differences from 50 for all 8 participants fell from 6.3 prior to the trial to 5.0 at Crossover, a reduction of 21%, and had fallen slightly further to 4.8 by the end of the trial, a total reduction of 24%.

Taken as separate groups:

- for those on active treatment the average fall was from 7.075 to 5.075, a reduction of 28% for the first group during the first 8-week period and from 4.925 to 4.825, a reduction of 2% for the second group during the second 8-week period; (or from 6.0 to 4.95, an average fall of 17.5% for all on the active treatment) whereas
- for those on placebo treatment the average fall was from 5.55 to 4.925, a reduction of 11% for the first group during the first 8-week period and from 5.075 to 4.85. a reduction of 4.5% for the second group during the second 8-week period; (or from 5.5 to 4.9, an average fall of 8% for all on the placebo treatment)

This set of readings therefore suggests an overall improvement in the group as a whole during the trial, with most of the improvement attributable to the active treatment.

Because 22 readings were taken for each participant it is possible to pinpoint if there were specific organs or organ systems that showed the main improvement.

For example in the data shown in Table 6a the total change during active treatment was from 176 to 120, a total of 56. This is made up mainly from:

- a reduction of 17 in Cell metabolism (ORCR)
- a reduction in 16 in Allergy (ALCR)
- a reduction of 10 in peripheral and CNS (NECL)
- a reduction of 8 in pericardium circulation (PCCR)
- a reduction of between 1 and 7 in 9 other systems totalling 34
- an increase of between 1 and 5 in 8 other systems totalling 29
- one unchanged reading

whereas during placebo treatment the total change was from 120 to 133 made up from

- a reduction of between 1 and 8 in 8 systems totalling 31
- an increase of between 1 and 9 in 13 systems totalling 44
- one unchanged reading

Perusal of data for these four largest changes from all participants (Table 6b) showed the following effects during 5 active treatments for

- cell metabolism (ORCR): 5, 17, 5, 12, -11 (+28)
- allergy (ALCR) : 17, 16, -1, 8, -9 (+31)
- P & CNS (NECL): 2, 10, 11, 5, 4 (+32)
- circulation (PCCR): 5, 9, 2, 8, 4 (+28)

when compared with the following effects on 6 placebo treatments:

- cell metabolism (ORCR): 1, 13,-6, 1, -2, -5 (+2)
- allergy (ALCR) : 2, -9, 3, 13, -9, 2 (+2)
- P & CNS (NECL): 2, -4, 0, -1, 1, -1 (-3)
- circulation (PCCR): -5, -9, 1, -3, 1, 1 (-14)

From these results it is clear that pulsed magnetic therapy has had a positive effect on cell metabolism (+28 vs +2), allergy (+31 vs +2), peripheral and central nervous system (+32 vs -3) and pericardium circulation (+28 vs -14).

This would appear to support at least some of the claims made for pulsed magnetic field therapy.

Summary of Observed Effects with Other Indicators of Change

Figure 7 summarises the observed effects at the end of the trial and compares them with other subjective responses and other indicators of change.

In only one of the participants (5y) was there a good correlation between measurements taken, subjective response and objective response. This person felt there had been an improvement. Measurements taken before and after the 8 weeks on the active device showed:

- improvement (reduction) in Progression Stage (Oxidative Stress) from 1.5 to 0.5 as shown on the Clot Retraction Test (with an increase to 2.75 during the subsequent placebo period);
- improvement (reduction) in Oxidative Stress of the Central Organs, particularly Gastro-intestinal Tract from 1.5 to 1.0 (with no change during placebo)
- a significant improvement in the average of the 22 readings on the Listen Machine from 43.0 to 46.6 (average of differences from 50 fell from 7.0 to 3.4) with improvements in NECR (peripheral and central nervous system, PCCR (pericardium – circulation), ALCR (allergy – food or general), ORCR (organ- cellular metabolism), THCR (endocrine system with pancreas), HTCR (heart) – all on right hand side; and LICL (large intestine), THCL (endocrine – Triple Warmer system) both on left hand side, (with no change during placebo);

In contrast with this the Lymphocyte Viability Test suggested a slight deterioration while on the active device (62% to 60%) and an improvement (60% to 89%) while on the placebo.

In a second participant (1x) readings were not taken after the period on the active device, but a good correlation was observed between subjective and objective responses. Comments suggested that improvement began during placebo period (Weeks 6-7:"Tumour size has reduced and feels as though it is breaking up" and "I feel re-born as though I have a second chance at life") and continued during active treatment ("Excellent health"). Breast tumour had decreased in size from 14 cm wide x 5cm deep to 12 cm x 3.5 cm deep during trial. It is therefore unlikely that the active treatment was the main factor in the tumour reduction.

A third participant (4x) had felt no improvement and in fact had believed that an increase in neck and back pain had occurred during the trial (starting while on the placebo). Measurements taken before and after the 8 weeks on the active device showed:

- T-Lymphocyte viability count rose from 68% to 79% (after falling from 73% to 68% on placebo);
- Progression stage improved from 1.75 to 0.75 (after deteriorating from 0.75 to 1.75 on placebo);
- Lymph stress fell from 2.0 to 0 (after rising from 1.0 to 2.0 on placebo);
- GIT system stress fell from 2.0 to 1.0 (after rising from 1.0 to 2.0 on placebo);

Thus 4 of the 5 types of measurement suggested improvement. The 5th (Listen Machine) showed a slight improvement of 1.0 (from 5.3 to 4.3) but only 0.4 of this occurred during active treatment. An improvement in LUCL,(lung - left), ORCL (organ – cellular metabolism - Left) and THCL (endocrine - Left) was accompanied by a larger deterioration in ALCR (allergy - right), ORCR (organ - cellular metabolism – Right) and THCR (endocrine – Right). It is of interest to note that the Clot Retraction Test also showed an improvement in endocrine – thyroid – left and a deterioration of endocrine thyroid – right during active treatment.

A fourth participant (2y) felt a tingling sensation attributed to the 'mat' but this was experienced on both active and placebo devices. Measurements taken before and after the 8 weeks active device showed:

- T-Lymphocyte viability count rose very slightly from 67% to 71% (and continued to rise to 76% on placebo);
- Progression stage improved from 2.25 to 0.75 (and worsened to 1.75 on placebo);
- Improvement of ~ 1.0 (7.5 to 6.5) on the Listen Machine (and continued to improve by another 1.0 (to 5.5) on placebo where it stabilised.

In contrast to these three measurements Lymph Stress worsened from 0.5 to 1.0; and there was no change in GIT Stress.

Four other participants had very little correlation between measurements, possibly because of effects of surgery and stress (from a family death) (4y), chemotherapy (3x and 5x), and RIFE therapy (2x).

Of the other two participants, one (1y) died halfway through the trial after 8weeks of active therapy and no readings could be taken after the treatment. The other discontinued after 5 weeks on placebo to travel overseas (with no benefits or effects observed).

Discussion

It is possible that the PMF device produces positive effects on the cancer process that are not being measured; or that the positive effects observed on the metabolic and other processes are not affecting the cancer process. The results of this trial therefore cannot demonstrate that PMFs have a positive effect on the cancer process; they can only suggest likely positive effects on body processes.

The results of this trial cannot necessarily be extrapolated to cancer patients in general because the particular group of participants was drawn from the membership of a Society that supports the alternative paradigm. Most participants were therefore implementing a wholistic program involving body (vitamins, supplements, etc), mind (meditation and other relaxation techniques) and spirit which could possible have affected the body's ability to respond positively to pulsating magnetic fields.

Since this trial was carried out a later version of the PMF device is being developed that recognises the difficulty of treating cancer patients with different types of cancer at different stages. It uses feedback from the NIRP/CMMD measurements to identify the optimum setting for the particular patient. This should help to overcome the problem identified in the above analysis, viz using a common protocol for all participants.

Conclusion

Results showed that there were no significant changes observed in the group receiving active treatment relative to their response with the placebo, on three of the four monitoring methods, although certain individuals appeared to have received some benefit and there was a possible slowing down of the cancer process. Using the fourth method, Electrodermal Screening Testing (the Listen Machine), a consistent improvement was observed across most participants. From these results it is clear that pulsed magnetic therapy has had a positive effect on cell metabolism, allergy, peripheral and central nervous system and pericardium circulation. This throws some light on the factors that might be important in reversing the cancer process and suggests that in future large-scale trials of PMF devices, suitable test be included for monitoring of these four major systems.

It is of interest to note that the measurements taken do not suggest an important role for the immune system in the control of the cancer process.

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Affiliations

Don Benjamin (Trial Leader): Convenor/Research Officer, Cancer Information & Support Society, St Leonards, a charity registered in NSW. (Also a distributor of the PMF device with proceeds going to the Cancer Information & Support Society.)
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Stephen Alexander (Listen Machine measurements): Director, Listen Systems Pty Ltd, Waverton NSW.
Tony Fitzpatrick (or Stewart Penny) (provision of PMF devices and computerised equipment for CMMD/NIRP measurements): PMF Products Pty Ltd, Coolum Beach, Queensland.
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Prof. Dr rer. Nat.G Fischer: (interpretation of the NIRP/CMMD data) University of Graz, Austria/Prof. Dr. Fischer AG, Weiterstadt, Chemnitz, Germany
Prof. Dr. Ing. M Krauss: (for interpretation of the NIRP/CMMD data) Prof. Dr. Fischer AG.

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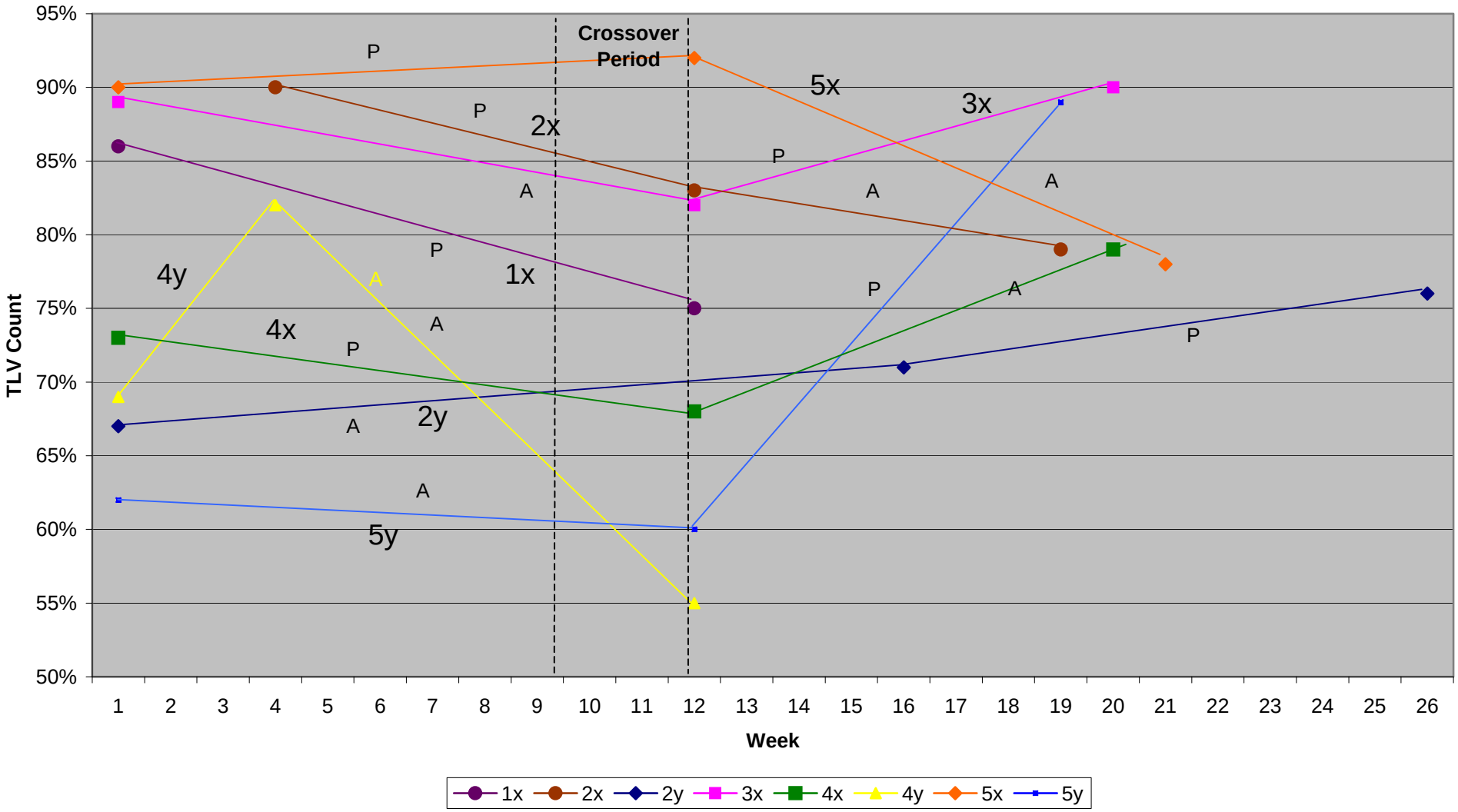
Table 1 Lymphocyte Viability Count

Week from	14 Nov	21 Nov	28 Nov	5 Dec	12 Dec	19 Dec	26 Dec	2 Jan	9 Jan	16 Jan	23 Jan	30 Jan	6 Feb	13 Feb	20 Feb	27 Feb	5 Mar	12 Mar	19 Mar	26 Mar	2 Apr	9 Apr	16 Apr	23 Apr	30 Apr	7 May
Subject									**Crossover**																	
1y									**Period**																	
				Active								Deceased														
2y	67%															71%										76%
				Active											Placebo											
3x	89%											82%								90%						
				Active											Placebo											
4y	69%			82%								55%									55%					
				Active											Placebo											
5y	62%											60%							89%							
				Active											Placebo											
1x	86%											75%									75%					
				Placebo											Active											
2x				90%								83%							79%							
				Placebo											Active											
3y																										
				Placebo								Discontinued														
4x	73%											68%								79%						
				Placebo											Active											
5x	90%											92%									78%					
				Placebo											Active											
Sum		626%										586%								621%						
Average		78%										73%								78%						

Figure 1 **T-Lymphocyte Viability Count**



35.

Table 2 Clot Retraction Test - Stage

Week from	14 Nov	21 Nov	28 Nov	5 Dec	12 Dec	19 Dec	26 Dec	2 Jan	9 Jan	16 Jan	23 Jan	30 Jan	6 Feb	13 Feb	20 Feb	27 Feb	5 Mar	12 Mar	19 Mar	26 Mar	2 Apr	9 Apr	16 Apr	23 Apr	30 Apr	7 May
Subject									**Crossover Period**																	
1y				Active									Deceased													
2y	2.25							0.75								1.75										2.00
				Active											Placebo											
3x	0.50							0.75				2.00								2.50						
				Active											Placebo											
4y	0.75			2.25					1.25			1.50								2.50						
				Active											Placebo											
5y	1.50							0.50				2.25							2.75							
				Active											Placebo											
1x	2.50							2.75				1.75														
				Placebo											Active											
2x				2.50					2.75			3.00							2.25							
				Placebo											Active											
3y	2.50							3.00																		
				Placebo								Discontinued														
4x	0.75											1.75								0.75						
				Placebo											Active											
5x	1.50											3.00									1.75					
				Placebo											Active											
Sum	9.75											15.25								14.50						
Average	1.39											2.179								2.071						

Averages for 7 participants do not include 1x, 1y or 3y for whom a complete set of readings was not available.

Figure 2

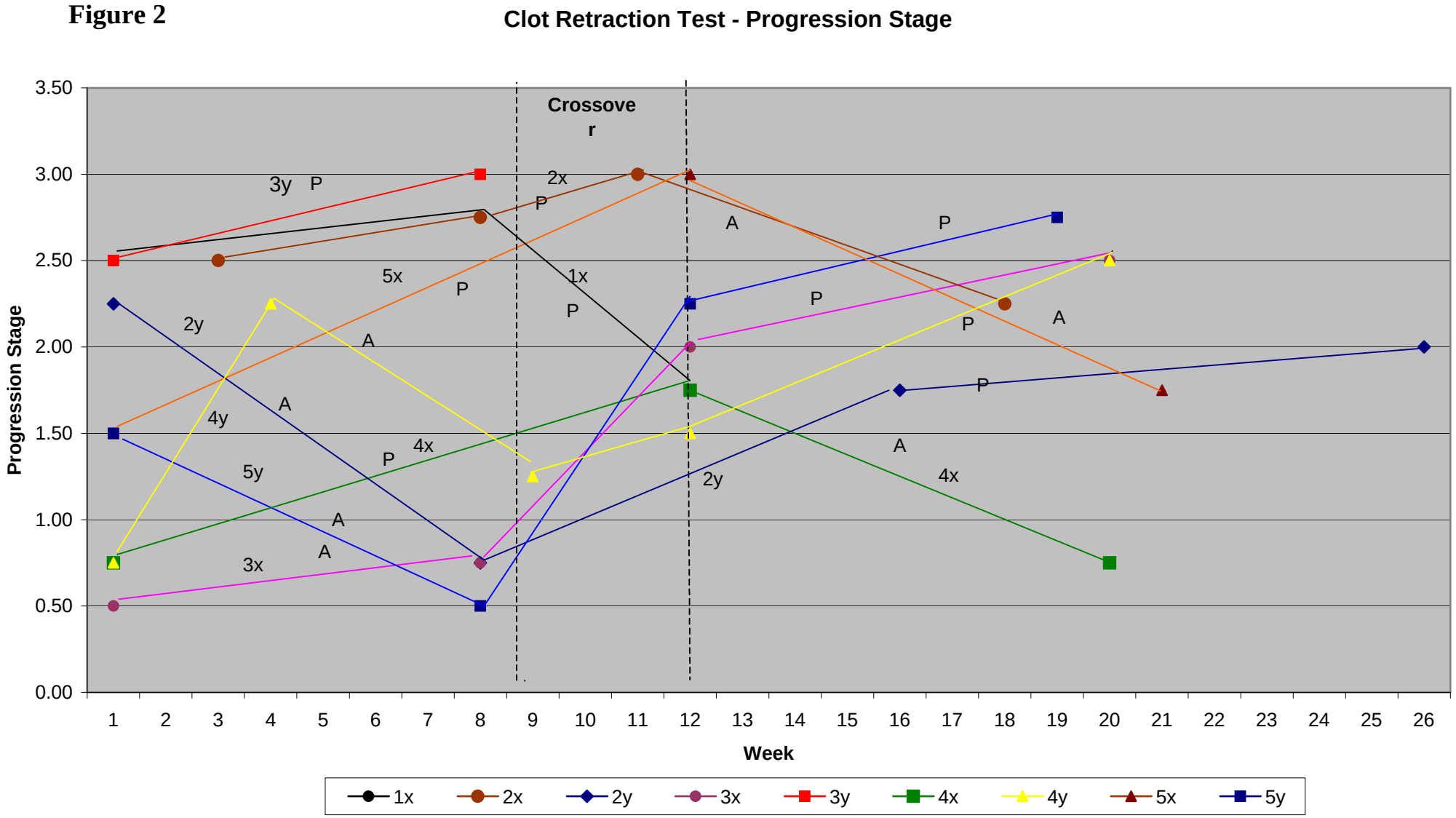

Clot Retraction Test - Progression Stage
Crossover
Progression Stage
Week
3.50
3.00
2.50
2.00
1.50
1.00
0.50
0.00
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26
3y P
2x P
A
P
5x P
1x P
2y
A
P
P
A
4y
A
4x P
A
5y
2y
4x
A
A
3x
P
1x
2x
2y
3x
3y
4x
4y
5x
5y

Table 3 Lymph Stress Test

Week from	14 Nov	21 Nov	28 Nov	5 Dec	12 Dec	19 Dec	26 Dec	2 Jan	9 Jan	16 Jan	23 Jan	30 Jan	6 Feb	13 Feb	20 Feb	27 Feb	5 Mar	12 Mar	19 Mar	26 Mar	2 Apr	9 Apr	16 Apr	23 Apr	30 Apr	7 May
Subject									**Crossover**																	
1y									**Period**																	
		Active																	Deceased							
2y	0.5							1.0								1.0										1.5
		Active														Placebo										
3x	1.5							0.5				1.0								2.0						
		Active														Placebo										
4y	1.0			3.0					1.0			2.0								1.5						
		Active														Placebo										
5y	0.0							0.0				0.0							1.5							
		Active														Placebo										
1x	1.0							2.0				2.0														
		Placebo														Active										
2x				1.5					1.0			2.5							2.0							
				Placebo												Active										
3y	1.0							1.0																		
		Placebo																	Discontinued							
4x	1.0											2.0								0.0						
		Placebo														Active										
5x	1.0											1.0									0.0					
		Placebo														Active										
Sum		7.5										9.5									8.5					
Average		1.07										1.36									1.2					

Averages for 7 participants do not include 1x, 1y or 3y for whom a complete set of readings was not available.

Figure 3 **Clot Reaction Test - Lymph System Stress**

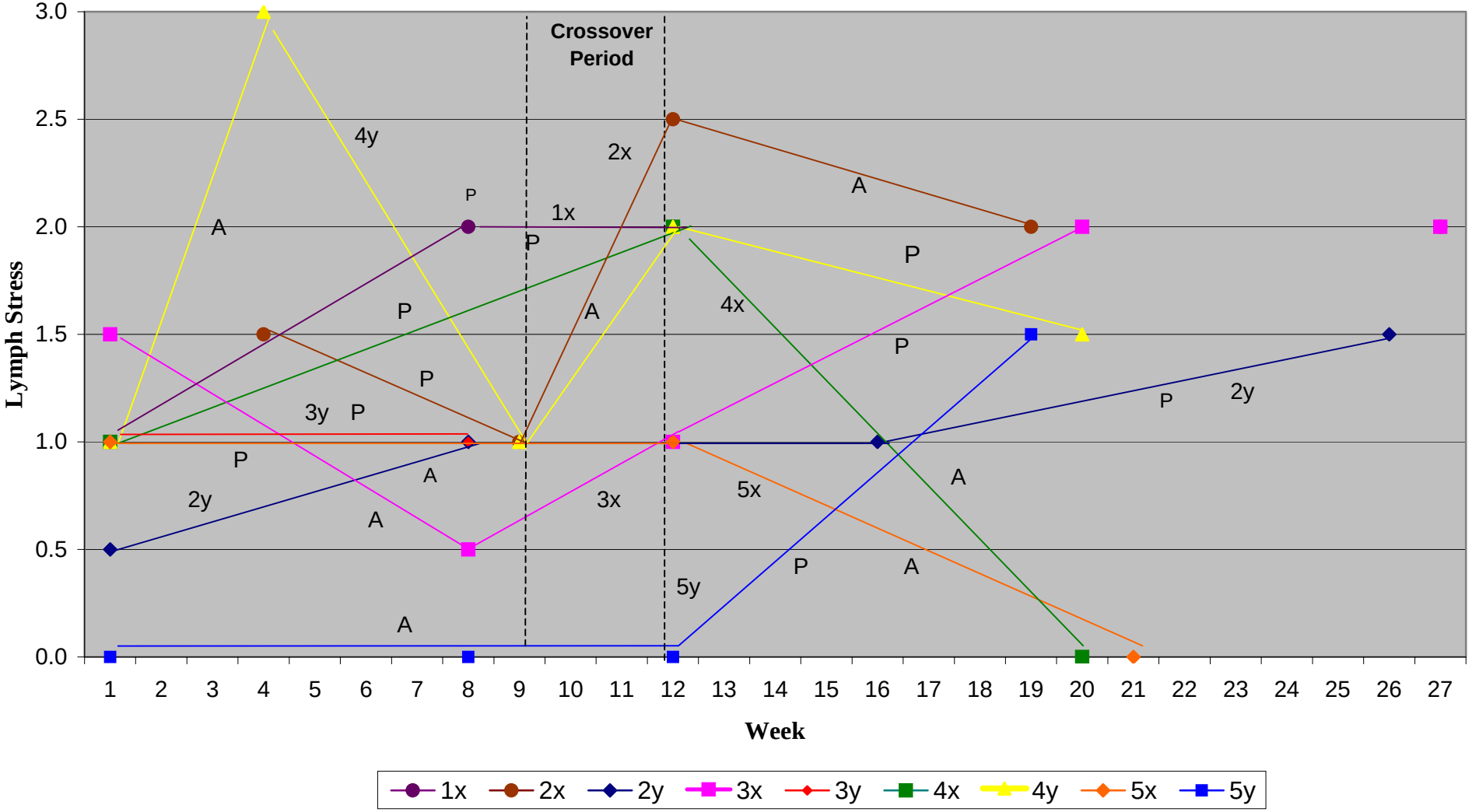


Table 4 Gastro-Intestinal System Stress Test

Week from Participant	14 Nov	21 Nov	28 Nov	5 Dec	12 Dec	19 Dec	26 Dec	2 Jan	9 Jan	16 Jan	23 Jan	30 Jan	6 Feb	13 Feb	20 Feb	27 Feb	5 Mar	12 Mar	19 Mar	26 Mar	2 Apr	9 Apr	16 Apr	23 Apr	30 Apr	7 May
									Crossover Period																	
1y		Active											Deceased													
2y	1.5							1.5								1.5										1.5
		Active														Placebo										
3x	0.0							1.0				2.5								2.0						
		Active														Placebo										
4y	0.5			1.0				2.0				2.0								1.0						
		Active														Placebo										
5y	1.5							1.0				2.0							1.0							
		Active														Placebo										
1x	1.5							2.5				1.5														
		Placebo														Active										
2x				2.0					2.0			3.0							0.5							
					Placebo											Active										
3y	3.0							2.0																		
		Placebo											Discontinued													
4x	1.0											2.0								1.0						
		Placebo														Active										
5x	1.5											1.0									1.5					
		Placebo														Active										
Sum		8.0											14.0								8.5					
Average		1.14											2.00								1.21					

Averages for 7 participants do not include 1x, 1y or 3y for whom a complete set of readings was not available

Figure 4 Clot Reaction Test - Gastro-Intestinal System Stress

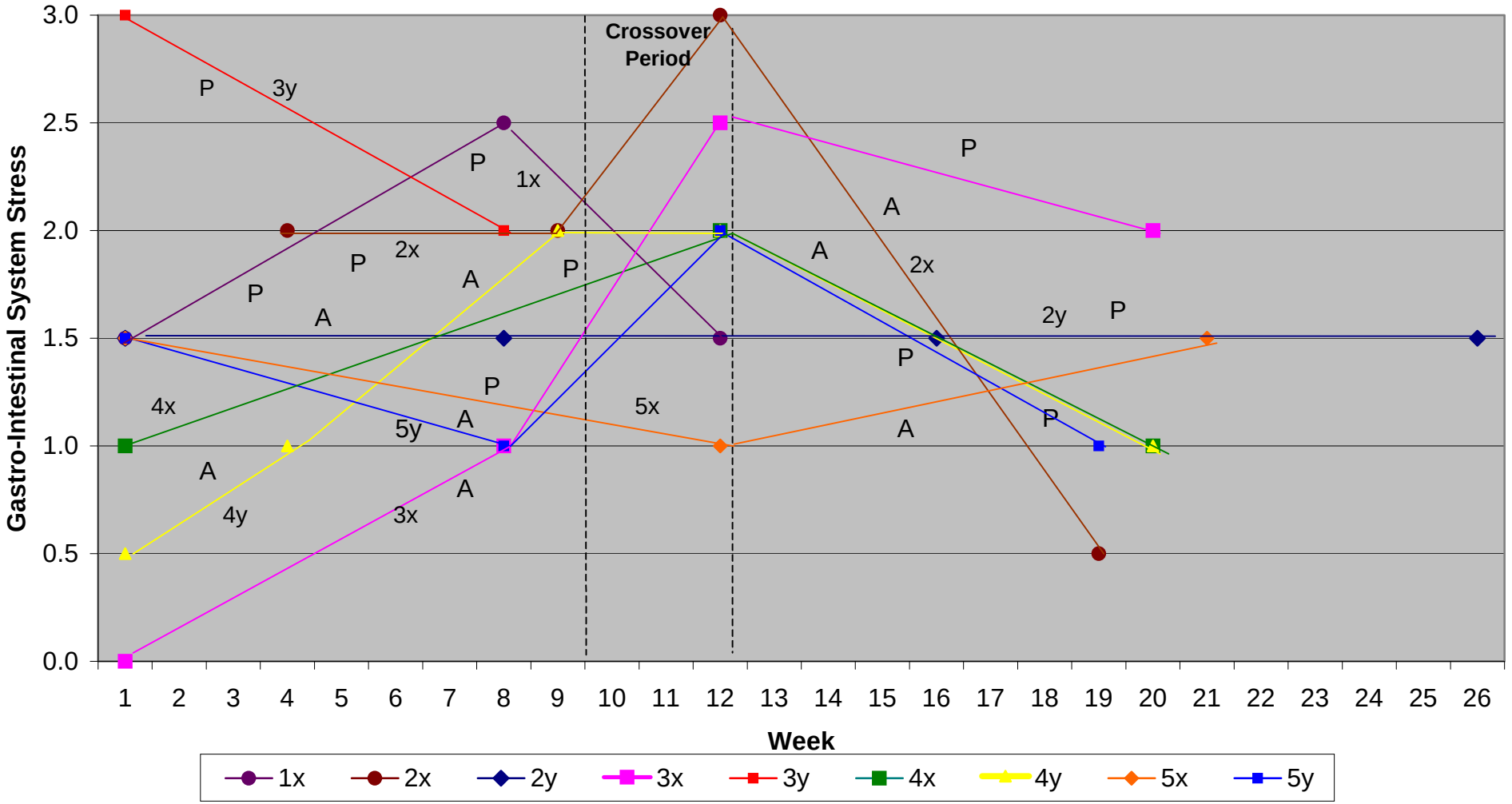


Figure 5

Table 6(a) Electro-dermal Screening Testing - Participant 3x

Life Information System Ten (LISTEN) - Point Codes
LYCR = **LY**(Lymph) **C**(CMP) **R**(Right) CMP = Control Measurement
Point R= Right side of body L= left side of body

		Participant 3x								
		18/11/1999 Before			25/1/2000 Crossover			6/4/2000 After		
		Min	Xn	[Xn]	Min	Xn	[Xn]	Min	Xn	[Xn]
LY1R	Palatino tonsil, with deep cervical lymph nodes - Right	47	3	3	44	6	6	48	2	2
LYCR	Lymph - sinuses - Right	44	6	6	47	3	3	48	2	2
LY2R	Drainage of jaw - odontons (teeth) - Right - Not measured									
LUCR	Lung - not pharynx or hypopharynx - Right	43	7	7	45	5	5	49	1	1
LICR	Large intestine - Right	43	7	7	40	10	10	47	3	3
NECR	Peripheral and central nervous system - Right	43	7	7	40	10	10	45	5	5
PCCR	Pericardium - circulation - Right	34	16	16	42	8	8	43	7	7
AL1R	Lower body, abdominal organs, chemicals & pesticides - Not measured									
ALCR	Allergy - food or general - Right	33	17	17	49	1	1	40	10	10
ORCR	Organ - cellular metabolism - Right	32	18	18	49	1	1	47	3	3
THCR	Endocrine system with pancreas & mammary gland - Right	51	-1	1	45	5	5	44	6	6
HTCR	Heart - Right	39	11	11	46	4	4	44	6	6
SICR	Small intestine - Right	42	8	8	47	3	3	47	3	3
LY1L	Palate - Left	43	7	7	38	12	12	46	4	4
LYCL	Lymph - Left	45	5	5	47	3	3	43	7	7
LY2L	Drainage of jaw - odontons (teeth) - Left - Not measured									
LUCL	Lung, lower passages - Left	41	9	9	47	3	3	45	5	5
LICL	Large intestine - Left	46	4	4	45	5	5	41	9	9
NECL	Peripheral & central nervous system - Left	33	17	17	43	7	7	44	6	6
PCCL	Pericardium - circulation - Left	42	8	8	44	6	6	39	11	11
AL1L	Lower body, abdominal organs, chemicals & pesticides - Not measured									
ALCL	Allergy - Left	38	12	12	43	7	7	41	9	9
ORCL	Organ - cellular metabolism - Left	46	4	4	41	9	9	40	10	10
TH1L	Gonads (ovaries & testicles) and adrenals - Left - Not measured									
THCL	Endocrine (Triple Warmer) system - Left	43	7	7	45	5	5	40	10	10
HTCL	Heart - Left	48	2	2	48	2	2	47	3	3
SICL	Small intestine - Left	50	0	0	45	5	5	39	11	11
		Sum[Xn]		176	Sum[Xn]		120	Sum[Xn]		133
		Ave[Xn]		8.0	Ave[Xn]		5.5	Ave[Xn]		6.0
				Active			Placebo			
Ave Min		42.1			44.5			44.0		

Table 6(b)

Electro-Dermal Screening Testing (Listen Machine)

Trial participant

	1x						2x						2y						3x						4x						4y			
Date	18/11/99 Before		11/2/00 Crossover		After		Before		25/01/00 Crossover		6/4/00 After		18/11/99 Before		8/3/00 Crossover		After		18/11/99 Before		25/1/00 Crossover		6/4/00 After		18/11/99 Before		25/01/00 Crossover		29/5/00 After		18/11/99 Before		25/01/0 Crossov	
BASE	Min	[Xn]	Min	[Xn]	Min	[Xn]	Min	[Xn]	Min	[Xn]	Min	[Xn]	Min	[Xn]	Min	[Xn]	Min	[Xn]	Min	[Xn]	Min	[Xn]	Min	[Xn]	Min	[Xn]	Min	[Xn]	Min	[Xn]	Min	[Xn]	Min	[
LY1R	50	0	45	5					49	1	51	1	47	3	37	13			47	3	44	6	48	2	58	8	55	5	49	1	54	4		
LYCR	50	0	46	4					55	5	46	4	52	2	38	12			44	6	47	3	48	2	59	9	54	4	49	1	52	2		
LY2R			46	4											35	15													60	10				
LUCR	39	11	45	5					49	1	50	0	43	7	40	10			43	7	45	5	49	1	41	9	45	5	45	5	56	6		
LICR	44	6	43	7					49	1	46	4	43	7	43	7			43	7	40	10	47	3	39	11	45	5	49	1	51	1		
NECR	36	14	45	5					51	1	47	3	44	6	53	3			43	7	40	10	45	5	48	2	55	5	48	2	41	9		
PCCR	49	1	44	6					49	1	40	10	39	11	44	6			34	16	42	8	43	7	49	1	50	0	48	2	43	7		
AL1R			44	6																														
ALCR	43	7	45	5					53	3	44	6	37	13	54	4			33	17	49	1	40	10	46	4	49	1	58	8	44	6		
ORCR	43	7	44	6					61	11	48	2	44	6	49	1			32	18	49	1	47	3	54	4	60	10	71	21	43	7		
THCR	50	0	45	5					52	2	45	5	44	6	51	1			51	1	45	5	44	6	52	2	56	6	71	21	65	15		
HTCR	55	5	47	3					54	4	50	0	44	6	49	1			39	11	46	4	44	6	49	1	52	2	51	1	45	5		
SICR	44	6	45	5					49	1	46	4	42	8	52	2			42	8	47	3	47	3	58	8	55	5	53	3	45	5		
LY1L	51	1	47	3					49	1	56	6	38	12	42	8			43	7	38	12	46	4	50	0	41	9	53	3	54	4		
LYCL	54	4	53	3					52	2	50	0	44	6	43	7			45	5	47	3	43	7	56	6	46	4	51	1	45	5		
LY2L			46	4											52	2													48	2				
LUCL	41	9	55	5					42	8	43	7	39	11	50	0			41	9	47	3	45	5	32	18	40	10	48	2	46	4		
LICL	46	4	45	5					45	5	44	6	45	5	42	8			46	4	45	5	41	9	57	7	49	1	55	5	40	10		
NECL	44	6	46	4					51	1	47	3	39	11	41	9			33	17	43	7	44	6	48	2	48	2	52	2	45	5		
PCCL	43	7	45	5					50	0	46	4	43	7	44	6			42	8	44	6	39	11	48	2	47	3	49	1	49	1		
AL1L																																		
ALCL	41	9	45	5					53	3	41	9	45	5	47	3			38	12	43	7	41	9	41	9	49	1	52	2	42	8		
ORCL	53	3	49	1					49	1	42	8	40	10	47	3			46	4	41	9	40	10	51	1	62	12	49	1	43	7		
TH1L									46	4																								
THCL	43	7	46	4					49	1	44	6	35	15	48	2			43	7	45	5	40	10	45	5	40	10	47	3	42	8		
HTCL	46	4	45	5					52	2	47	3	48	2	47	3			48	2	48	2	47	3	53	3	50	0	53	3	57	7		
SICL	43	7	48	2					50	0	47	3	43	7	45	5			50	0	45	5	39	11	45	5	47	3	51	1	51	1		
	Sum[Xn]	118	Sum[Xn]	112	Sum	0	Sum	0	Sum [Xn]	59	Sum[X	94	Sum[Xn]	166	Sum[X	131	Sum	0	Sum[Xn]	176	Sum[Xn	120	Sum[X	133	Sum[Xn]	117	Sum[Xn]	103	Sum[Xn]	102	Sum[Xn]	127	Sum[Xn]	
	Ave[Xn]	5.4	Ave[Xn]	4.5	Ave	0	Ave[	0	Ave[Xn]	2.6	Ave[Xr	4.3	Ave[Xn]	7.55	Ave[Xn	5.5	Ave[	0	Ave[Xn]	8.0	Ave[Xn]	5.5	Ave[Xr	6.0	Ave[Xn]	5.3	Ave[Xn]	4.7	Ave[Xn]	4.3	Ave[Xn]	5.8	Ave[Xn]	
			Placebo		Active				Placebo		Active				Active		Placebo				Active		Placebo				Placebo		Active				Active	

Summary

	Active		Placebo		Active	
1x			5.4	4.5	4.5	?
1y			Deceased			
2x			?	2.6	2.6	4.3
2y	7.5	5.5	5.5	?		

Figure 6 **Electro-Dermal Screening Testing (Listen Machine)**

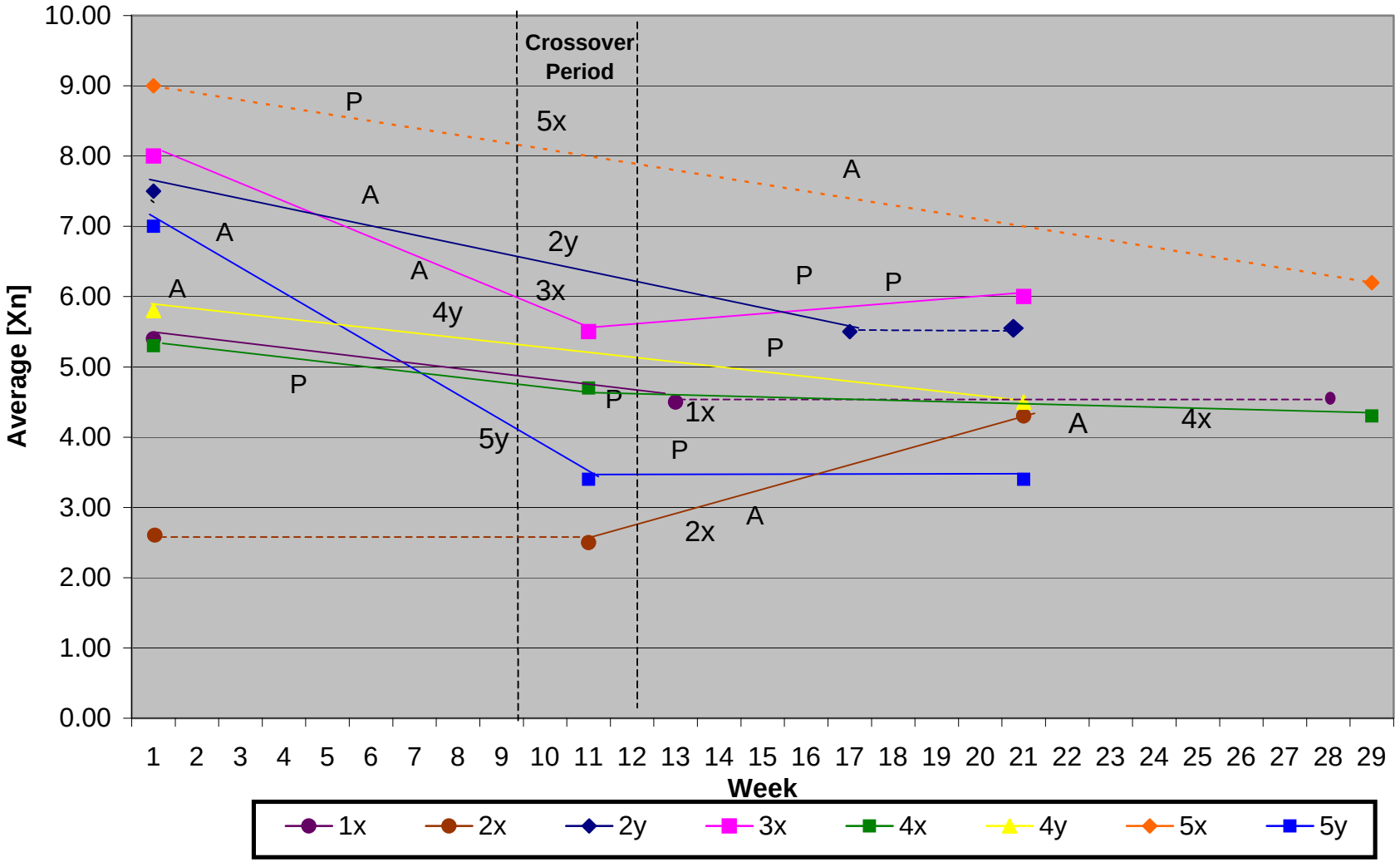


Table 7 Summary of Observed Effects with Other Indicators of Change

Participant	Comments	Observed changes							Other observations
		TLV	CRT			NIRP / CM MD	Listen	Over-all	
			Stage	Lymph stress	GIT				
1x	Mat has benefited her	No readings taken after active period							Breast tumour decreased in size from 14 cm wide x 5cm deep to 12 cm x 3.5 cm deep during trial
1y	No benefits.	No readings taken after active period							Underwent chemo for 5 months prior to trial. Died during second part of trial.
2x	No clear benefits	Slight fall	Clear Improvement	Slight Improvement	Large Improvement		Significant Deterioration PCCR, ALCR, LY1L, ALCL, THCL	+/-	RIFE therapy during weeks 6-8 (placebo) and during second 8-week period (active). New tumour found 10 months later
2y	Tingling sensation (active), energised (placebo)		Clear Improvement	Slight Deterioration	-		Improvement: ALCR, LUCL, ORCL,THCL	+/-	
3x	Slightly improved. Increased energy after liver cleansing diet during crossover.			Slight Improvement	Slight Deterioration		Significant improvement: PCCR, ORCR, HTCR, NECL	+	New tumour grew in different part of brain during trial. Died 5 months later.
3y	No benefits (placebo)	No readings taken							Discontinued after 5 weeks on placebo.
4x	Neck and back pains attributed to mat (placebo)	Slight Increase	Slight improv-ement	Clear Improvement	Slight improv-ement		Slight Improvement: LUCL, ORCL, THCL. Deterioration: ALCR, ORCR, THCR	(+)	Neck and back pains continued also when on active mat. No positive effects observed.
4y	No effects felt (placebo or active). Getting attached to mat. After 8 min don't want to get up (active)	Deterioration, possibly due to surgery	Tempo-rary improvement.	Large fluctuations	Deterioration		Improvement: LUCR, NECR, THCR, LICL, ALCL, THCL, Deterioration: HTCR, LUCL	+/-	First 8 weeks (active) were stressful time. Mother-in-law died. CT scan confirmed metastases above collarbone. During second 8 weeks attended Gawler Workshop.
5x	No benefits observed (placebo or active)	Deterioration, possibly due to chemo-therapy/ radio-therapy	Clear improvement	Slight improv-ement	-	-	Significant improvement: LUCR, ALCR, LYCL, THCL, SICL. Deterioration: LICR.	+/-	Weeks 4-7 took mat overseas. Weeks 10-13 on chemo-therapy; weeks 15-16 radiotherapy. Died 10 months later.
5y	Positive benefits	-	Improvement	-		-	Significant improvement: NECR, PCCR, ALCR, ORCR, THCR, HTCR, LICL, THCL, Deterioration: LUCL.	+	Scare following trial when foot swelled and X-rays revealed new growths in spine (found to be non-malignant)