FANTASTIC FINDINGS

Prolotherapy as an Alternative to Surgery

A Prospective Pilot Study of 34 Patients from a Private Medical Practice

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ABSTRACT

Thirty-four patients with average musculoskeletal pain duration of 27 months who were told by their medical doctor/surgeon that surgery was needed, including 20 joint replacements and nine arthroscopic procedures, were treated with Hackett-Hemwall dextrose Prolotherapy in lieu of surgery. Patients were followed prospectively and asked questions regarding levels of pain, stiffness, and other physical and psychological symptoms, as well as questions related to activities of daily living before and after their last Prolotherapy treatment.

In this study, Prolotherapy caused a statistically significant improvement in their pain and stiffness. The average starting level of pain was 7.6 and stiffness 7.2, but after Prolotherapy they decreased to 1.3 and 2.5 respectively. Ninety-one percent of patients felt Prolotherapy gave them 50% or greater pain relief, and 71% felt the pain relief was greater than 75%. Upon interview, an average of 10 months after their last Prolotherapy session, this study revealed improvement in patients' quality of life parameters in addition to pain and stiffness including depression, anxiety, medication usage, as well as range of motion, sleep and exercise ability. Seventy-nine percent felt they had enough pain relief with Prolotherapy that they will not now or in the future need surgery. Four of the remaining seven patients noted 50% or greater pain relief from the Prolotherapy and plan on getting more Prolotherapy in the future.

In this study, Prolotherapy was able to eliminate the need for surgery realistically in 31 out of 34 patients. If Prolotherapy could eliminate 80% of musculoskeletal surgeries in the United States, this procedure alone could make a tremendous dent in cost savings to Medicare, private insurers, and patients. This does not include the money that is lost from productivity and additional expenses that accompany surgery such as future or revision surgeries, rehabilitation, physiotherapy, medications, or disability (from continued pain). Prolotherapy does not have the risks associated with surgery. Often patients can immediately return to work after receiving Prolotherapy. Since results with Prolotherapy are often permanent, no future treatments are needed. These are reasons enough for patients to consider a Prolotherapy evaluation before undergoing a musculoskeletal surgery.

As this pilot study found such significant improvements in these participants with chronic musculoskeletal pain who were told that surgery was needed, further studies under more controlled circumstances, with larger patient populations, should be done.

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KEYWORDS: alternative to knee replacement, alternative to surgery, arthroscopy, joint replacement, Prolotherapy.

INTRODUCTION

Chronic pain is a recurring medical dilemma in the United States. It has been estimated that over one third of the American population suffers from chronic pain, and some studies indicate a much higher incidence of pain experienced regularly.[1-3] While chronic pain effects many areas of the body, low back pain is the most common form of chronic pain, with an estimated 80% of people suffering from back pain at some point in their lives.[4] After back pain, knee and shoulder pain are the most often reported musculoskeletal complaints according to one study.[5] Businesses in the United States alone lose 61.2 billion dollars per year in loss of productivity because of employee disability due to chronic pain.[6]

This rise in chronic pain is accompanied by an increase in surgical procedures as a pain treatment. Common surgeries that are used to intervene for the pain are knee and shoulder arthroscopy, back, neck or ankle fusion, and knee and hip joint replacement. From the years 1990 to 1996 total hip replacement surgery increased by 23%, one in seven of them were revision surgeries.[7]

In a study looking at total hip and knee replacements performed annually from 2000 to 2004, the number of hip replacements increased from 164,458 to 225,900, and knee replacements increased from 281,534 to 431,485, a jump of 37% and 53% respectively. The same study projected in 2015 that the number of total hip replacement surgeries will reach nearly 600,000, and total knee replacements will reach nearly 1.4 million.[8] (*See Figure 1.*) Another study by Cowen, published in Neurosurgery in 2006 states from 1993 to 2003 spinal fusions rose from the 41st most common inpatient procedure to the 19th most common, with cervical fusions increasing by 89%, thoracolumbar fusions by 31% and lumbar fusions by 134%.[9] A definite increasing trend is seen with musculoskeletal surgical procedures.

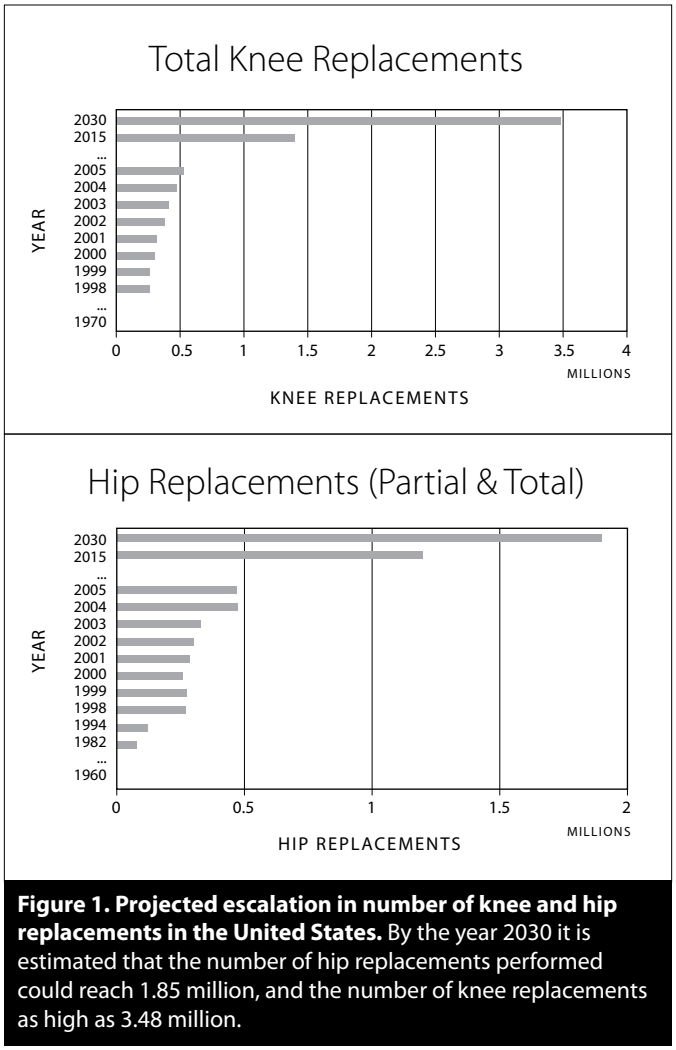
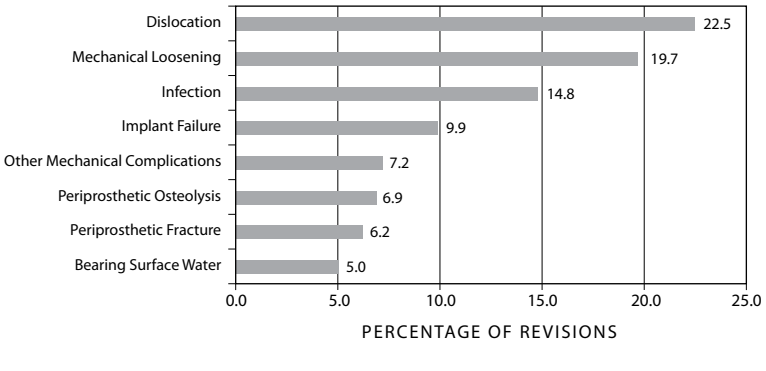


Figure 1. Projected escalation in number of knee and hip replacements in the United States. By the year 2030 it is estimated that the number of hip replacements performed could reach 1.85 million, and the number of knee replacements as high as 3.48 million.

With the increase in surgical procedures comes significant increases in healthcare costs, as a total hip replacement has an average cost of $39,299, while a total knee replacement can cost $35,000 or more.[10, 11] Health care costs associated with knee replacement surgery amounts to around $2 billion annually nationwide and if the hospital charges grow with inflation that cost is estimated to amount to nearly $80.2 billion for all primary revised hip/knee replacement surgeries by 2015.[12] Spinal-fusion surgery has an average hospital bill of more than $34,000, not including professional fees.[13] Surgical cost is only one limiting consideration relating to chronic pain.

While surgery for pain is sometimes a necessary treatment, it carries risk. A relatively common complication associated with surgical procedures is the need for revision surgery. Statistics from The Hospital for Special Surgery showed that in 1973 the need for hip replacement revisions were fewer than 1%, but by 1983 revision rates had risen to 10%.[14] A later study published in the same journal saw the revision rate between 1990 and 2002 for total hip arthroplasties increase by 3.7 per 100,000 procedures, along with total knee revision arthroplasties increasing by 5.4 procedures for every 100,000.[15] The most common causes of revision total hip arthroplasty are hip instability, mechanical loosening, and infection. (*See Figure 2.*) Given this trend, it is projected that from the years 2005 to 2030, the hip revision rate will increase by 137% and knee revision rates will have increased by 601%.[16]



Source: Bozic KJ, et al. The epidemiology of revision total hip arthroplasty in the United States. *J Bone Joint Surg (Am).* 2009;91: 128-133.

Figure 2. Each revision total hip arthroplasty is over $55,000 in costs just for the hospitalization alone.

Revision surgery is only one risk associated with musculoskeletal surgery. Many patients have concerns about other possible risks that accompany surgery which include peri-operative risks such as deep vein thrombosis, along with more intermediate and long-term risks including loosening and wearing of the prosthesis and pseudarthrosis.[17-19] Dislocation is also of concern to hip arthroplasty patients, as it is a regular occurrence and the risk increases with each revision surgery required.[20-24] The need for a blood transfusion is common and of concern, as patients may lose a significant enough amount of blood during a joint replacement surgery to require a transfusion.[25-27] Spinal fusions are sometimes recommended for back pain, but the fusion success rate is sub-optimal and the patient may still experience post-fusion pain, in addition to a long recovery time.[28-30] Artificial discs also present problems by leaving patients with persistent pain symptoms after implantation.[31, 32] In addition, lumbar fusion failures have been shown to cause radiculopathy, degeneration in adjacent discs, and nerve injuries.[33-36] In relation to the knee, various studies showing arthroscopic debridement and arthroscopy report no benefit for knee osteoarthritis and often leave the patient with chronic pain and complications.[37-40] Ankle replacement surgery has been used for patients with ankle pain, but also reports historically high complication rates, along with a number of failures.[41-43]

Because surgery carries risks and complications and often does not cure pain symptoms, patients are seeking alternatives with the same or greater results. Prolotherapy is one alternative that patients are now turning to. Prolotherapy works by initiating a brief inflammatory response, which causes a reparative cascade to generate new collagen and extra cellular matrix giving connective tissue their strength and ability to handle strain and force.[44, 45] This healing cascade produces fibroblasts, which is critical for the repair of tendons and ligaments. Simply put, the affect of Prolotherapy is similar to that of an injury except with Prolotherapy there is no disruption of the architecture of the tissue. High-resolution ultrasounds have been used to confirm that Prolotherapy does indeed stimulate tissue growth.[46] One double-blinded animal study by Dr. Liu showed that Prolotherapy increased ligament mass by 44%, ligament thickness by 27%, and ligament bone junction strength by 28%.[47]

The doctor that introduced Prolotherapy into mainstream medicine practice was George S. Hackett, MD.[48] In a study of 206 traumatic headache patients published by Dr. Hackett and colleagues, 79% were completely relieved of their headaches.[49] In regards to low back pain, a survey revealed that 82% of 1,178 patients treated with Prolotherapy considered themselves cured.[50]

While Prolotherapy has been traditionally used for ligament and tendon injuries, it has a long history of use in osteoarthritis and other degenerative conditions.[51-53] Because surgery for degenerative conditions carries risks and complications and often does not totally resolve the patients' pain or even makes it worse; patients are turning to Prolotherapy as an alternative to surgery. Prior studies on Prolotherapy done at a charity clinic run by the primary author have shown that Prolotherapy eliminates pain even in those patients who have been told by their medical doctor(s) that surgery was the only treatment option for their pain.[54-57] (*See Table 1.*) To further document the success rate of Prolotherapy in helping patients who have been told by an orthopedic surgeon or other physician that surgery was needed to resolve their musculoskeletal pain, this study was undertaken.

Table 1. Results from prior studies done on the effects of Prolotherapy for patients whose doctor told them that surgery was the only option for their chronic pain.*

Painful body part where Prolotherapy was performed	Average pain level prior to Prolotherapy	Average pain level after Prolotherapy	Percent of patients who reported greater than 50% pain relief from Prolotherapy
Knee	6.8	3.0	100%
Back	6.0	2.1	96%
Neck	6.6	2.1	90%
Shoulder	7.0	2.6	90%
Hip	7.1	2.4	100%

* Hauser R, et al. A retrospective study on dextrose Prolotherapy for unresolved knee pain at an outpatient charity clinic in rural Illinois. *JOP*. 2009;1:11-21.

Hauser R, et al. A retrospective study on Hackett-Hemwall dextrose Prolotherapy for chronic hip pain at an outpatient charity clinic in rural Illinois. *JOP*. 2009;2:76-88.

Hauser R, et al. Dextrose Prolotherapy for unresolved low back pain: a retrospective case series study. *JOP*. 2009;3:145-155.

Hauser R, et al. A retrospective study on Hackett-Hemwall dextrose Prolotherapy for chronic shoulder pain at an outpatient charity clinic in rural Illinois. *JOP*. 2009;4:205-216.

Hauser R, et al. Dextrose Prolotherapy for unresolved neck pain. Practical Pain Management. 2007;7(8):56-69.

Hypothesis: Prolotherapy can resolve pain, even in patients who were told by a medical doctor(s) that surgery is needed for their painful condition.

Objective: To investigate the outcome of patients who underwent Prolotherapy treatment as an alternative to surgery.

Method: In early 2007, unresolved chronic pain patients seeking Prolotherapy at a private medical practice in lieu of surgery were followed prospectively to determine if Prolotherapy treatments resulted in pain relief.

Conclusions: In this study, we observed that patients with unresolved musculoskeletal pain had a statistically significant improvement in their pain and stiffness, as well as significant functional gains in other measures in quality of life, including walking ability, after receiving Hackett-Hemwall dextrose Prolotherapy in lieu of surgery.

Methods

PATIENT CHARACTERISTICS

A total of 34 patients were treated for their chronic pain at Caring Medical, a private Prolotherapy practice in Oak Park, Illinois and followed for their response to Prolotherapy. The average age of patients was 57 years-old with 18 being male and 16 female. All patients were told by a medical doctor(s) that surgery was needed to resolve their pain and 91% were told that surgery was their only option. The patients represented 21 knees, five hips, two wrists, two ankles, two feet, one shoulder, and one lower back. The operations the patients were trying to avoid were 20 joint replacements, nine arthroscopic procedures, three fusions, and four tendon/ligament repairs. The reasons the patients chose not to have surgery varied: 34% natural medicine minded, 18% personal choice, 18% risks, 9% family decision, 3% expense, and 3% fear. Prior bad experience with surgery was not a reason any of the patients received Prolotherapy. Fifty-nine percent of the patients being treated knew of others who had benefited from Prolotherapy. The average length of pain patients reported prior to receiving Prolotherapy was 27 months. The average patient had seen 2.5 physicians prior to receiving Prolotherapy. The average patient was taking 1.1 medications for pain before receiving Prolotherapy. Thirty-two percent of patients were taking one pain medication per day before receiving Prolotherapy, and 18% were taking two to three pain medications per day. (*See Table 2.*)

Table 2. Patient characteristics at baseline.

Total number of patients treated	34
Percent told surgery was needed	100%
Percent told surgery was only option	91%
Average age of the patients	57
Average number of prior physicians seen	2.5
Average length of pain (in months)	27

INTERVENTIONS

The participants received the Hackett-Hemwall technique of Prolotherapy. A 15% dextrose, 10% Sarapin and 0.2% lidocaine solution was used as the base solution. Patients being treated for peripheral joint degeneration also received 2IU of Human Growth Hormone injected into their joints. General inclusion criteria were a history of musculoskeletal pain and being told by a medical doctor/surgeon that surgery was needed, as well as being an appropriate Prolotherapy candidate. Guidelines for the latter included having joint motion at least 50% of normal, motivation to get better, a willingness to stop anti-inflammatory or narcotic medications, and determination to receive the necessary number of visits required for Prolotherapy to resolve or reduce the pain complaint.

OUTCOMES

An independent data collector (DP) was the sole person obtaining the patient information. The data was obtained before and after the patients had received their Prolotherapy treatments. Follow-up telephone contact was made when it had been at least three months since their last Prolotherapy session.

For the analysis of the patient data, patient percentages of the various responses were calculated by another independent data collector (DG), who also had no previous knowledge of Prolotherapy. These responses gathered from patients before Prolotherapy were then compared with the responses to the same questions after Prolotherapy.

Results

TREATMENT OUTCOMES

Patients received an average of 4.5 Prolotherapy treatment sessions. The average time of follow-up after their last Prolotherapy session was 10 months. Prior to Prolotherapy the average patient was taking 1.1 medications for pain, but this decreased to 0.2 after Prolotherapy. Thirteen patients were able to stop taking medications or decrease them because of Prolotherapy. One of the 26 patients not on pain medications following Prolotherapy had to resume since stopping Prolotherapy.

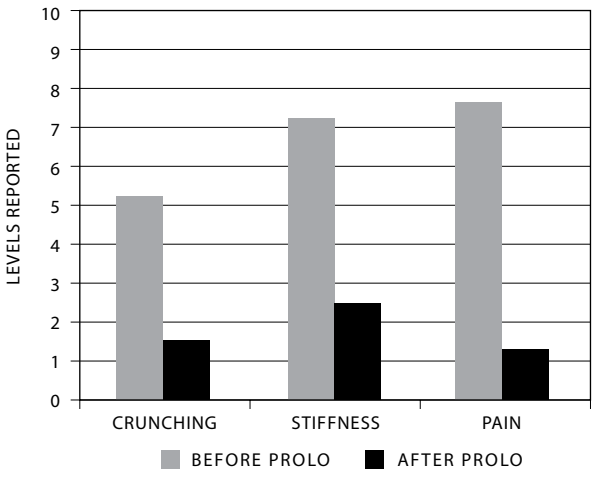


Figure 3. Levels reported by patients for crunching, stiffness, and pain before and after Prolotherapy.

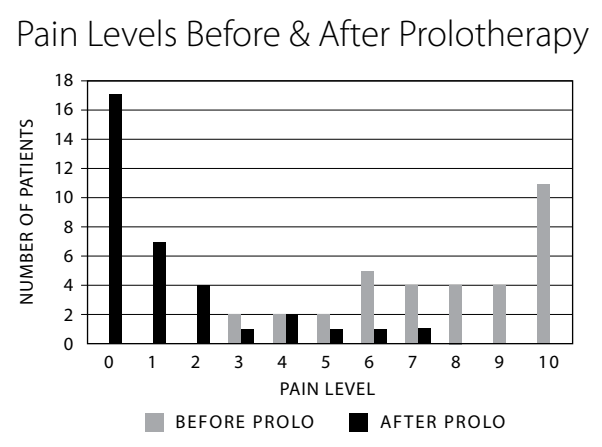


Figure 4. Starting and ending pain levels before and after receiving Hackett-Hemwall dextrose Prolotherapy in 34 patients who underwent Prolotherapy treatments as an alternative to surgery.

Patients were asked to rate their levels of crunching, stiffness, and pain on a scale of 0 to 10, with 0 being no crunching/stiffness/pain and 10 being severe/crippling crunching/stiffness/pain. The average starting crunching level was 5.2, the average starting stiffness level was 7.2, and the average starting pain level was 7.6. Following Prolotherapy, patients reported an average ending crunching level of 1.5, an ending stiffness level of 2.5, and an average pain level of 1.3. (*See Figure 3.*) The before and after Prolotherapy pain levels are seen in *Figure 4*. Ninety-one percent of patients felt Prolotherapy gave them 50% or greater pain relief, and 71% felt the pain relief was greater than 75%. Of patients who still reported pain, 21% felt they stopped the Prolotherapy sessions too soon.

Before Prolotherapy, 6% of patients had normal range of motion, but that increased to 24% after Prolotherapy. Prior to Prolotherapy, 9% of patients had only a slight restriction of motion (75% or greater of normal range of motion), but this increased to 77% after Prolotherapy.

In regard to activities of daily living (ADL), 50% of participants said their overall disability was 50% or greater, due to pain. After Prolotherapy, none of the participants had an overall disability of greater than 50%. Seventeen percent of patients had an overall disability of 25% or less, but after Prolotherapy this increased to 81%. Specifically, before Prolotherapy 23% felt that in regard ADLs (including bathing and dressing self), they were dependent on someone else, but after Prolotherapy 100% of patients were independent in ADLs. Concerning another important quality of life issue, only two (6%) out of the 34 patients reported having normal walking ability prior to treatment, but after treatment this increased to 20 (59%). (*See Figure 5.*)

Before receiving Prolotherapy, 53% of the patients reported feelings of depression, and 62% reported feelings of anxiety. After receiving Prolotherapy, 94% were no longer depressed and 71% were no longer anxious. Prior to Prolotherapy, 76% of the patients reported hindered sleep due to chronic pain. After receiving Prolotherapy, 79% of patients noticed that their ability to sleep had much improved.

When patients were asked if Prolotherapy had changed their life for the better, 91% answered "yes." Only one out of the 34 patients said Prolotherapy did not help their

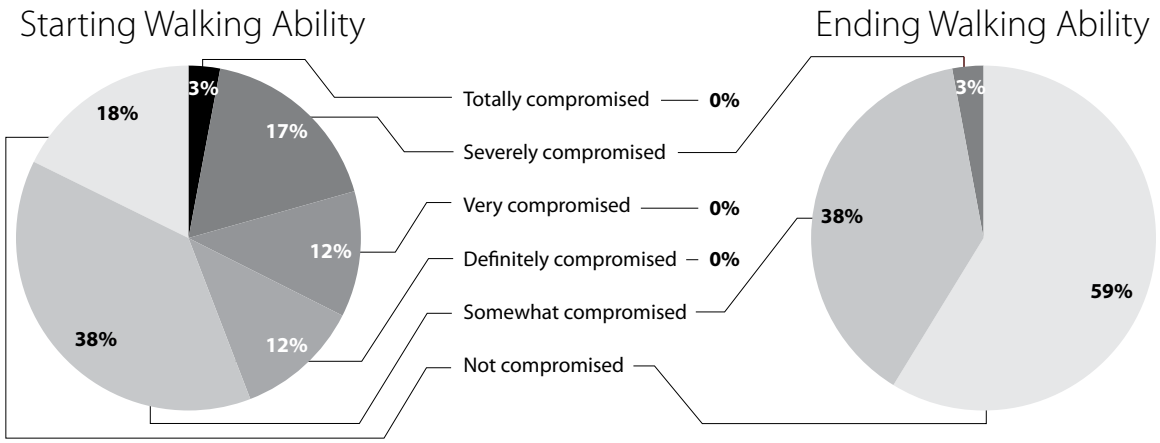


Figure 5. Starting and ending walking ability before and after receiving Hackett-Hemwall dextrose Prolotherapy.

pain. Three out of 34 (9%) received less than 25% pain relief with Prolotherapy. Seventy-nine percent of the patients answered "yes" to having enough relief after their Prolotherapy treatment that they felt they will never need surgery. For the seven patients (21%) who answered "no" to that question, three felt they will need surgery. The four remaining patients noted greater than 50% pain relief, but plan to receive additional Prolotherapy treatment in the future. Of interest, is 100% of the patients treated stated that they have recommended Prolotherapy to someone else.

Statistical Analysis

A matched sample paired t-test was used to calculate the difference in responses between the before and after measures for pain and stiffness. The paired sample t ratio was computed on this pre-post Prolotherapy study. The paired t ratios for all the groups were highly significant, using N pairs minus one as the degrees of freedom. For the entire 34 participants the paired t ratio was significant for pain reduction ($t = 16.085$, $p<.0000001$). For the analysis on stiffness resolution, the paired t was also highly significant ($t = 11.323$, $p<.0000001$). In summary, for the 34 participants in this study, their pain and stiffness was significantly reduced at the $p<.0000001$ level by Hackett-Hemwall dextrose Prolotherapy.

Discussion

PRINCIPLE FINDINGS

The results of this prospective, non-controlled, pilot study show that Hackett-Hemwall dextrose Prolotherapy helps decrease pain and improve the quality of life of pain patients who have been told that they need surgery to resolve their musculoskeletal pain. Decreases in pain and stiffness reached statistical significance. On a scale of 0 to 10, the ending pain, stiffness, and crunching (crepitation) levels were 1.3, 2.5, and 1.5 respectively. Nine-one percent of participants received 50% or greater pain relief with Prolotherapy. Seventy-nine percent of patients felt they had enough current pain relief with Prolotherapy that they will never need surgery. Four (12%) of the patients received 50% or greater pain relief with Prolotherapy, but plan to receive additional Prolotherapy in order to avoid surgery. Three of the patients (9%) felt they will still need surgery. Additional noted improvements were seen overall in range of motion, walking ability, depressive and anxious symptoms, sleep and need for pain medication. One-hundred percent of patients recommended Prolotherapy to someone they know.

In regard to the three participants who ended up needing surgery; one had terrible shoulder pain especially with playing sports. He had failed physical therapy, cortisone injections, and medications for an intrasubstance tear of the supraspinatus tendon and impingement syndrome. He stated the two Prolotherapy treatments helped him 15%, but he was and is an active cricket player and decided on

surgery. He is back to playing. Of interest is this participant at various times had five other body areas treated with Prolotherapy and responded 100%. The second patient who ended up needing surgery had osteoarthritis of the hip. He had six Prolotherapy treatments and felt he was 90% better in regard to pain from the Prolotherapy. He noted that he was sleeping and walking better since receiving Prolotherapy. Objectively, he had more range of motion with the Prolotherapy, but not enough for his activity level. He had a successful hip replacement. The third participant received two Prolotherapy treatments to her degenerated knee. She stated the Prolotherapy helped 50% with the pain but she was anxious to get back to dancing (her passion), and decided to get a total knee replacement. She is back to dancing.

While these three participants would be considered "failures" of Prolotherapy because they needed surgery, on closer examination it is clear that two of the patients did not receive the recommended number of treatments before stopping Prolotherapy. In the experience of the primary author (R.H.), patients who have been told by surgeons that surgery is their only option can often require at least six visits of Prolotherapy, especially if they have joint degeneration to the point of "bone on bone." These three patients do demonstrate the challenge that doctors who utilize Prolotherapy face daily in active patients, that they want to get better quickly. While surgery is not a quick fix, Prolotherapy does require a patient to go to a doctor's office and receive the treatment every month, sometimes for six months to a year. While this can be a stumbling block to some patients, for the patient who does not want to have surgery, surely this is a small inconvenience for a lifetime of pain relief.

STRENGTHS AND LIMITATIONS

Our study cannot be compared to a clinical trial in which an intervention is investigated under controlled conditions. Instead, it is aimed to document the response in a private medical practice of patients to Prolotherapy who have been told that surgery is needed to resolve their pain. Clear strengths of the study are the numerous quality of life parameters that were studied. Such quality of life issues as overall disability, walking ability, stiffness, range of motion, activities of daily living, sleep, anxiety and depression, in addition to pain level, are important factors affecting the person with pain. The statistically significant improvement in pain and stiffness levels, as well as improvements in quality of life measured, treated solely by Prolotherapy, even though subjective, is likely to have resulted from Prolotherapy.

Another strength of this study is that the study population received only Prolotherapy as a treatment for their pain; no other treatment modalities were used. While all 100% of patients were told by a medical doctor(s) that surgery was needed to resolve their pain, *91% were told by a medical doctor(s) that surgery was the only treatment option that would resolve their pain*. This is further evidence that the amount of pain and disability suffered by these patients was significant. Patients with this caliber of pain and degeneration typically do not experience spontaneous pain improvement, so resolution of their symptoms most likely resulted from the Prolotherapy they received.

A weakness of this study is that there was not a control group. Also the study did not isolate one particular patient population in regard to diagnosis necessitating a specific type of surgery. The lack of X-ray or MRI correlation for diagnosis and response to treatment was also a limitation.

INTERPRETATION OF FINDINGS

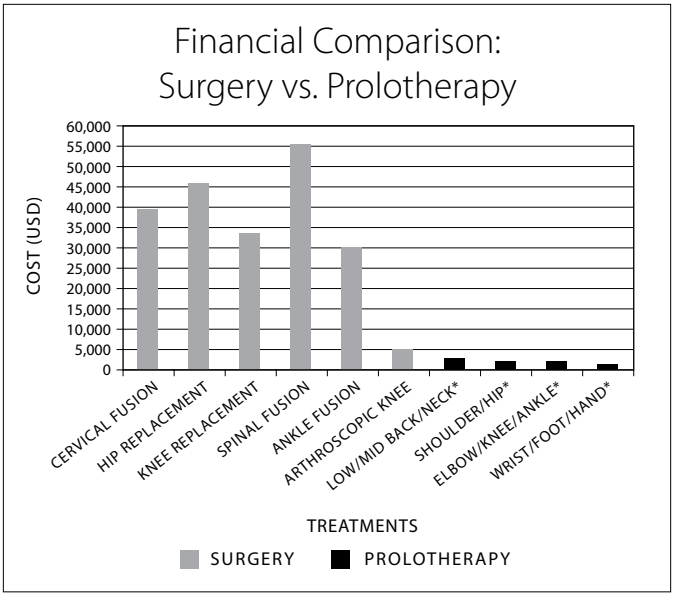
In 2004, there were 3.4 million operations on the musculoskeletal system necessitating and inpatient hospital stay.[58] While advances in technology and surgery are admirable; the cost of the surgeries is astronomical. In 2004 the estimated cost of performing spinal fusions was $17.6 billion and discectomy was $11.25 billion. While over a million hip and knee total joint replacements were performed in 2004 at a cost estimated at $30 billion, there are many reasons for people in chronic pain to forego surgery for their pain including risk with the procedure, lack of results, financial burden, inability to work while recovering, as well as personal preference toward natural healing techniques. While one can debate the efficacy of Prolotherapy versus surgery for specific medical diagnoses and symptoms, the cost comparison between the two is not debatable. Excluding the additional costs of rehabilitation, physiotherapy, repeat procedures, side effects, post-operative medications, and future medical problems caused by the surgeries, Prolotherapy is significantly less expensive than the commonly performed surgeries. (*See Figures 6a & 6b.*)

In the current study, conservatively 79% of the patients receiving Prolotherapy felt that Prolotherapy did resolve their painful condition to the point that they will not now,

Surgery Type	Average Cost of Surgery
Cervical Fusion	$39,000
Hip Replacement	$46,000
Knee Replacement	$33,000
Spinal Fusion	$56,000
Ankle Fusion	$30,000
Arthroscopy Knee	$5,000
Prolotherapy Type	**Average Cost of Treatments**
Low/Mid Back/Neck*	$2,500
Shoulder/Hip*	$1,875
Elbow/Knee/Ankle*	$1,875
Wrist/Foot/Hand*	$1,125

* The average person requires 4 to 6 treatment sessions given at 4 to 6 week intervals. Prices displayed are based on an average of 5 treatment sessions.

Figure 6a. Cost comparison of surgery versus Prolotherapy.



* The average person requires 4 to 6 treatment sessions given at 4 to 6 week intervals. Prices displayed are based on an average of 5 treatment sessions.

Figure 6b. The cost of Prolotherapy is significantly lower as compared to surgical procedures.

nor in the future, need the previously recommended surgical procedure. That number increases to 91% if you include the additional four patients who already had 50% or more pain relief with Prolotherapy and plan to get more Prolotherapy. Using a conservative number, such as 80% for the number of surgical procedures that would be eliminated with Prolotherapy, the cost savings if patients received Prolotherapy versus surgery are enormous. For instance, in the United States the number of knee replacements in the year 2015 is estimated to be 1.4 million. If 80% of these could be eliminated by patients receiving Prolotherapy now, the cost savings just in these surgeries alone would be $78 billion in the U.S. Imagine if 80% of the 4 million arthroscopies on the knee could be eliminated. This would save the U.S. health care system another $32 billion per year. If Prolotherapy could eliminate 80% of musculoskeletal surgeries in the United States, this procedure alone could make a tremendous dent on saving Medicare, private insurers, and patients money. (*See Table 3.*) This again does not include the money that is lost from lost productivity, and additional expenses that accompany surgery such as rehabilitation, physiotherapy, future procedures, medications, and disability (from continued pain).

When a person undergoes Prolotherapy, they often go right back to work after the appointment. There is no lost work productivity except the time it takes to go to the Prolotherapy appointment. After Prolotherapy, the person is instructed not to take narcotic or anti-inflammatory medications, as these decrease the healing with Prolotherapy. Normally no medications are needed after Prolotherapy. It is also quite common with Prolotherapy that no physiotherapy or other pain therapies are needed. Typically results with Prolotherapy are permanent. No future Prolotherapy is needed. These are reasons enough for patients to consider a Prolotherapy evaluation before undergoing a musculoskeletal surgery.

Table 3. Potential cost savings with Prolotherapy instead of common musculoskeletal surgeries.*

* Data extrapolated for the year 2015 to demonstrate if Prolotherapy was done today so these surgeries would not be needed.

Surgery Type	Estimated surgery cost in the year 2015	Estimated number of these surgeries in the year 2015	Dollar savings estimating 80% elimination of these surgeries with Prolotherapy	Dollar savings estimating 90% elimination of these surgeries with Prolotherapy
Knee Replacement	$70,000	1.4 million	$78.4 trillion	$88.2 trillion
Hip Replacement	$80,000	600,000	$38.4 trillion	$43.2 trillion
Knee Arthroscopy	$10,000	8 million	$64 trillion	$72 trillion
Spinal Fusion	$68,000	500,000	$27.2 trillion	$30.6 trillion
Shoulder Arthroscopy	$10,000	1.5 million	$12 trillion	$13.5 trillion

Conclusion

Ninety-one percent (31 out of 34) of patients who were told by at least one medical doctor that they needed surgery to resolve their chronic musculoskeletal pain complaint felt Hackett-Hemwall dextrose Prolotherapy changed their life for the better. In this study, Prolotherapy caused a statistically significant improvement in their pain and stiffness. Upon interview, on average 10 months after their last Prolotherapy session, this study revealed improvement in patients' quality of life parameters in addition to pain and stiffness including depression, anxiety, medication usage, as well as range of motion, sleep and exercise ability. Seventy-nine percent felt they had enough pain relief with Prolotherapy that they will not now or in the future ever need surgery. Four of the remaining seven patients, noted 50% or greater pain relief from the Prolotherapy and plan on getting more Prolotherapy in the future.

Since this pilot study found such significant improvements in these participants with chronic musculoskeletal pain who were told that surgery was needed, further studies under more controlled circumstances with larger patient populations should be done. ■

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