Introduction

In 2002 the total prevalence of diabetes in the United States was 18.2 million people – an estimated 6.3% of the population. Diabetes mellitus is a group of diseases characterized by high levels of blood glucose levels due to insufficient, or lack of, insulin production. Insulin is the hormone responsible for the absorption of glucose into cells for energy use and into the liver and fat cells for energy storage. There are two types of diabetes mellitus: Type 1, also known as insulin-dependent diabetes, is the more severe form. It usually first appears in people under age 35, most commonly ages 10-16. It develops rapidly, as the insulin-secreting cells in the pancreas are destroyed. Without regular injections of insulin, coma can quickly ensue, often resulting in death. Type 2 diabetes, also known as non insulin-dependent diabetes, usually occurs gradually and mainly affects people over age 40, but also occurs in children and adolescents. This disease is characterized by insufficient production of insulin and the patient’s body is often resistant to the effects of insulin. In most cases, the combination of dietary measures, weight reduction, and oral medication keeps the condition under control.

The National Diabetes Data Group has established diagnostic criteria for diabetes mellitus. Diagnostic criteria for diabetes is a plasma or serum glucose level of greater than or equal to 140mg/dL after an overnight fast on two occasions in an adult or child. According to the American Diabetes Association, however, any fasting plasma glucose

Case Study

Resolution of Type 2 Diabetes Mellitus in a Patient Undergoing Subluxation Based Chiropractic Care and Dietary Recommendations: A Case Study

Abstract

Objective: The effects of chiropractic care and dietary modifications on a patient with a 20-year history of type 2 diabetes are described.

Clinical Features: A 61-year-old male presented to the chiropractor with a 20-year history of type 2 diabetes. Subluxations were located and corrected and dietary modification changes were recommended and adopted by the patient.

Intervention and Outcome: Chiropractic adjustments using Diversified Full Spine as well as Pettibon techniques were applied to the sites of vertebral subluxations. Dietary modification to reduce inflammation in the body was recommended as well. These interventions are collectively part of what is referred to as Maximized Living protocol. After 1 month of chiropractic treatment and dietary changes the patient decided to cease taking medication for treatment of his type 2 diabetes, and after 2 months of chiropractic care he returned to his medical doctor who confirmed that his blood-glucose levels had normalized.

Conclusions: The chiropractic care and dietary modifications of a patient with a 20-year history of type 2 diabetes contributed to the resolution of his diabetes diagnosis. Future research is necessary to determine individual effects of chiropractic care and dietary modifications on type 2 diabetes, as well as on a larger scale to determine whether the larger population of diabetic patients can benefit from a combination of chiropractic care and dietary modifications.

Key Terms: Chiropractic, Pettibon, Diversified technique, vertebral subluxation, Diabetes Mellitus, Maximized Living
level above 126mg/dL should be considered as a diagnostic criterion for diabetes mellitus. This paper will discuss the effects of the correction of vertebral subluxations through specific chiropractic adjustments and dietary modifications on the resolution of type 2 diabetes mellitus.

**Case Report**

**Patient History**

The patient was a 61-year-old male who presented to our office with difficulty concentrating. Upon taking the patient history, it was noted that the patient had a 20-year history of type 2 diabetes, for which he was taking 3 different oral medications daily at the time. His medications included Precose, an alpha-glucosidase inhibitor; Glipizide, a sulfonylurea; and Metaformin, a biguanide. Upon his initial diagnosis of diabetes, he had gone to his medical doctor for a physical examination due to lack of energy. The patient’s blood-work was monitored multiple times per year throughout his life. The patient reports that he was overweight most of his life, at around 212 pounds, and that he had a poor diet with little variety.

After receiving his initial diagnosis of diabetes mellitus, the patient had experienced bouts of low back pain for which he sought chiropractic care at various chiropractic offices. The duration of care never lasted longer than a few visits to alleviate his pain. The patient saw no changes in his diabetes during this sporadic chiropractic care.

Approximately one year prior to starting chiropractic care the patient’s fasting blood glucose level was 133mg/dL even with oral medication – well above the American Diabetes Association’s diagnostic level of 126mg/dL. After his medical doctor made medication changes, the patient’s blood work was analyzed again and a few months later the plasma glucose reading was 100mg/dL. Four months before beginning care the reading was 89mg/dL. The patient’s diabetes mellitus symptoms at this point were under control due to the medications he was taking. He reports that he had not made any dietary changes at that time.

**Chiropractic Examination**

Approximately 20 years after the patient received his diagnosis of diabetes he presented to our office for chiropractic care. The chiropractic exam included blood pressure analysis, postural analysis, cervical, thoracic and lumbar ranges of motion, spinal thermography scan, static electromyography scan, and spinal anterior to posterior and lateral full spine x-rays.

Blood pressure analysis revealed 132/82 mmHg. Cervical, thoracic, and lumbar ranges of motion were all within normal limits. Postural distortions were noted including a right head tilt and left high shoulder.

According to Harrison et al, postural stress has been correlated with scoliosis, office work, work-related lifting injuries, driving, sitting, space flight, sports injuries, and back pain. As a valid outcome of care it is universally accepted by most health care sciences.

Thermography using the Insight Millenium thermal scanner was used. For years thermography has been used by chiropractors to assess for vertebral subluxation. Because the skin is actively involved in thermal adaptation to maintain a constant homeostatic temperature, observations of bilateral para-spinal thermographic imbalances have been useful in detecting abnormal neurological activity. It is theorized that these thermographic patterns are demonstrative of a person’s decreased ability to adapt to a constantly changing internal and external environment. Thermography instrumentation has been used as a model for demonstrating quality control in the chiropractic clinical setting, and has shown reliability of reproducing thermal pattern scans using a series of different instruments in different adjusting rooms.

The Insight Millenium thermal scanner is a hand-held device that is connected to a computer and interpreted by Insight Millenium software. It assesses autonomic nervous system function by measuring skin temperature differentials. It is rolled up the spine at pre-determined segments. For this case, the thermal scanner measured segments S1 (first sacral segment) to C1 (first cervical segment). The data is interpreted and displayed on the computer screen as various colors indicating abnormal temperature differentials. White bars are normal, green bars indicate mild elevation of skin temperature, blue bars indicate moderate elevation, and red or black denote severe temperature differential readings. This data allows the chiropractor to make objective conclusions about autonomic dysfunction and its relationship with vertebral subluxation.

Surface electromyography was also used on this patient upon examination. This technology is useful in evaluating para-spinal muscle tone. It is used as an adjunct in finding and measuring abnormalities of para-spinal muscle tone and has been used since 1948 to determine the relationship between back pain and muscular activity. Electromyography involves recording electrical potentials that are associated with muscular activity. Surface electrodes are placed on the skin over the muscles being studied and involve scanning 15 paraspinal sites, including every other spinal segment level, plus the transitional areas of the spine. High readings are determined by increased electrical potentials along the para-spinal muscles.

According to a review by Kent and Gentempo, the literature indicates that surface techniques demonstrate superior test-retest reliability. Results of the review demonstrated that para-spinal EMG scanning may be useful in documenting the soft tissue component of the vertebral subluxation complex and monitoring the response of a patient to a course of chiropractic care. There is further evidence in the literature to support that information gathered from para-spinal SEMG scans in
addition to other assessment data, may support exam findings in determining asymmetrical muscle contraction, severity of any particular condition, and responses to chiropractic adjustments.9

For the purpose of this examination, amplitude was the main objective factor assessed using the SEMG. The term ‘amplitude’ refers to the signal or action potential of the para-spinal muscle measured in microvolts. The higher the signal is, the greater the muscle activity.

Results are compared to normative data, thus elevated or decreased signals can be identified.9 Abnormal readings are categorized using a color system; green is mild increased activity, blue is moderate increased activity, and red or black indicate severe increased activity.

Results of this patient’s initial thermal scan were as follows: C1 severe on right, C2 mild on right, C3 moderate on right, C5 mild on right, C6 mild on left, T10-L2 mild on right, and L3 moderate on right [FIGURE 1]. Results of the SEMG scan were as follows: C1 mild on the right, C3 mild bilaterally, T1 mild on the left, T4 mild on the left, L1 mild on the right [FIGURE 2].

Radiographic analysis revealed multiple areas of subluxation. Anterior to posterior full spine and lateral full spine films were obtained at the initial exam. Osteophytes – which are abnormal outgrowths on bone due to abnormal stress and are clinical signs of osteoarthritis – as well as disc degeneration, were noted in the cervical spine at the levels of C2/3, C3/4, C4/5, C5/6, and C6/7. In the thoracic spine osteophytes and disc degeneration were noted at the levels of T4/5, T5/6, T6/7, T7/8, and T8/9.

Subluxation listings were recorded at multiple areas on the radiographs. Such listings are necessary to describe the abnormal position of vertebrae. “A” denotes anterior movement of the vertebra. “P” denotes posterior movement of the vertebra. “R” or “L” denote that the spinous process of the vertebra has rotated either to the right or left, respectively. “S” and “I” denote superior or inferior movement of the spinous process, respectively, rotating on the vertical axis, creating a wedge at that segment.

The listings are summarized as follows: The anterior to posterior full spine film indicated C1 ASL, C3 PRS, C7 PRS, T2 PRI, T3 PRI, T6 PRS, T9 PRI, T12 PLI, L2 PLI, L4 PRI.

A center of gravity line was measured from the second sacral tubercle to the center of the odontoid of C2, revealing a left 7mm deviation from center (normal is 0mm) [FIGURE 3]. The lateral full spine film indicated an atlas plane line of 24 degrees (normal is 31 degrees), a 35-degree cervical lordosis measured between C2 and C7 (normal is 42 degrees), and 23mm of anterior head carriage (normal is 0mm) [FIGURE 4].

The use of plain-film radiography in the practice of chiropractic is well supported as a means for analyzing subluxations of the spine.10 Such radiographs are helpful in assessing the biomechanical components of the vertebral subluxation.11, 12 According to Harrison et al, the use of radiography for identification of any abnormal lateral cervical configuration is mandatory.9

Interventions

Recommendations were made for chiropractic care after the initial exam. The patient’s initial care plan included 3 visits per week for 12 weeks, totaling 36 visits. Diversified full-spine and Pettibon techniques were used with this patient.

Pettibon technique’s primary objective is postural correction. For more information about the features of this technique please refer to the discussion section of this paper. Prior to each adjustment, the patient used Pettibon cervical traction and wobble-chair devices. The cervical traction device consists of a rope fixed to a wall with height adjusted to accommodate each patient. On the other end of the rope is a cushion that fits behind the neck of the patient, and a small bar that is gripped by the patient that sits under the chin. It is used for loading and unloading to reestablish necessary motion in both the cervical and lumbar spine. The patient was instructed to complete 20 repetitions on the traction equipment each visit prior to each adjustment, increasing 5 repetitions each visit until a maximum of 60 repetitions was achieved.

The wobble chair is a specially-designed seat that provides 360 degrees of rotation, 40 degrees of side to side flexion and 35 degrees of front to back flexion to facilitate all possible combinations of exercise motion needed for lumbar disc mobility, re-hydration, nutrition delivery, and waste elimination. A regimen of 5-8 minutes was prescribed to the patient to be completed prior to each adjustment.

Diversified full spine technique involves finding specific areas of subluxation using static and motion palpation of the patient’s spine, as well as using thermal and static electromyography scanning devices to pinpoint abnormalities, and radiographic findings. Once the location of the subluxation has been determined, a specific, high-velocity, low-amplitude adjustment is introduced in the spine. Typically the patient received a pelvic or lumbar adjustment, a thoracic-region adjustment, followed by a cervical-region adjustment.

Nutritional Recommendations

Recommendations were made to the patient for dietary modification. The modifications were recommended in order to help reduce inflammation within the body. These recommendations are based on scientific evidence supporting a Paleolithic diet for improving glucose tolerance. A Paleolithic diet is based on lean meat, fish, fruits, vegetables, root vegetables, eggs, and nuts.13 The patient was provided dietary modifications that removed all sugars and grains and increased his intake of healthy saturated fats and nutrient-dense vegetables.
Outcomes

The patient began care in our office and received 36 chiropractic adjustments to correct vertebral subluxations before being re-evaluated two months later. After 6 adjustments the patient reported that he was feeling much better. After 12 adjustments the patient reportedly had adopted the dietary modifications that were recommended to him, and he also reported at this point that he felt much better than when he had initially entered the office. At this time the patient also reportedly had decided to cease taking all of his oral medications for control of his diabetes.

Thermal and SEMG scans were obtained at 12 visits, 24 visits, and 36 visits. Results of the thermal and SEMG scans can be observed in Figures 1 and 2.

Comparative radiographs were taken after 36 visits. The anterior to posterior full spine film showed a 3mm center of gravity line deviation (an improvement of 4mm). The lateral cervical film showed a 30-degree atlas plane line (an improvement of 6 degrees). The cervical lordosis was measured at 35 degrees (no change), and 15mm of anterior head carriage was measured (an improvement of 8mm). These can be observed in Figures 3 and 4.

Three months after beginning care the patient returned to his medical doctor for blood work. His plasma glucose levels were at 114 mg/dL, well below the diagnostic level of 126 mg/dL. The patient was not taking any medication for diabetes at this time. The patient reported that he felt much better and had more energy.

Discussion

Type 2 Diabetes Mellitus

Type 2 diabetes mellitus makes up approximately 90% of all cases of diabetes. It typically occurs in older overweight individuals. A lifestyle involving excessive caloric intake, inadequate caloric expenditure, and obesity increases the risk of developing type 2 diabetes.14

It has been suggested that health care providers offer counseling to their patients in order to promote physical activity, a healthy diet, and cessation of smoking as a means of prevention. There are multiple detrimental musculoskeletal conditions associated with diabetes. Such conditions include muscle cramps, complex regional pain syndrome, limited joint mobility, neuropathic joints, carpal tunnel syndrome, osteoporosis, and osteomyelitis, among others.14 Many of these physical ailments are debilitating.

According to the American Diabetes Association, the national cost of diabetes in the U.S. in 2007 exceeded $174 billion. This number includes $116 billion in excess medical expenditures attributed to diabetes, as well as $58 billion in reduced national productivity. People with diagnosed diabetes, on average, have medical expenditures that are approximately 2.3 times higher than the expenditures would be in the absence of diabetes. Approximately 1 in 10 health care dollars is attributed to diabetes. Indirect costs include increased factors such as absenteeism, reduced productivity, and lost productive capacity due to early mortality.15

There is some research in the literature demonstrating resolution of diabetes through chiropractic care and dietary modifications. One case study demonstrated normalized blood glucose and urine levels after one month of chiropractic adjustments and dietary modifications in a patient diagnosed with early onset diabetes mellitus.16 A case study of a 9-year-old female with type 1 diabetes mellitus showed achievement of blood glucose control with stabilization of the amount of insulin required per day after receiving regular chiropractic adjustments and implementing minor dietary modifications.17

A study by Webster et al measured the acute effects of upper cervical chiropractic adjustments on 6 patients with type 2 diabetes. Plasma glucose levels were obtained one week prior to the first adjustment. Immediately following the first adjustment, plasma glucose levels were measured again at 60, 120 and 180 minutes.

Results showed a progressive decrease in plasma glucose levels over the 3 hours.18 The study did not monitor effects over extended periods of time, however.

Another study, though not directly related to normalizing blood-glucose levels, was found in the literature showing the effects of chiropractic adjustments on musculoskeletal complaints of diabetic patients. A study by Valli demonstrated improvement in chronic neck and shoulder pain in a chiropractic patient with a 21-year history of type 1 diabetes.19

Chiropractic Care

The chiropractic profession was founded on the premise that vertebral subluxations create dysfunction within the body, whereby after their removal through a chiropractic adjustment, normal physiological function is restored. The Association of Chiropractic Colleges defines subluxation as a complex of functional and/or structural and/or pathological articular changes that compromise neural integrity and may influence organ system function and general health.20 There are various descriptive models of vertebral subluxation. One of those models is known as the neurodystrophic model. This model is based on the premise that increased sympathetic tone due to vertebral subluxation can alter organ and tissue responses to hormones, infectious agents, and blood components. Decreased thresholds of efferent neurons in the spinal cord result in increased impulses to the somatic and visceral structures that are innervated by the affected neurons.21

Based on this model, one could make the assumption that removal of a vertebral subluxation might improve the cell’s ability to respond to insulin in the case of a type 2 diabetic patient, whereby normalizing plasma glucose levels after a certain number of chiropractic adjustments to remove the subluxation and restore function to the body.
Type 2 Diabetes

According to Kent, there are multiple clinical applications to the correction of vertebral subluxation. In a literature review, Kent summarized three clinical approaches to subluxation: The segmental model, dealing with the correction of specific motion segments; the postural approach, dealing with subluxations which are viewed as postural distortions or “global” subluxations; and finally the tonal approach, which deals with variations in nerve tension.21

Pettibon technique can be categorized under the postural approach described by Kent. Pettibon technique acknowledges the detrimental affects of gravity on the human spine and posture. According to Dr. Pettibon, “The nervous system always wants us to hold our heads upright. And the nervous system will do this at the expense of displacing the lower spine.” The Pettibon System begins with an x-ray, including typically 7 views of the spine. The initial set of x-rays is compared to those taken during treatment to monitor progress. Scientific measurements are made of the direction and amount of spinal displacement.22

Nutritional Recommendations for Type 2 Diabetic Patients

A healing diet to reduce inflammation in the body was recommended to the patient. There is evidence to support that this dietary modification plan has improved health benefits for glucose-intolerant patients. A 2009 study found that a Paleolithic diet improved glycemic control and several cardiovascular risk factors over 3-months, compared to a diabetes diet in patients with type 2 diabetes.13 Another study in 2006 which studied the affects of a Paleolithic diet in domestic pigs suggests that such a diet conferred higher insulin sensitivity, lower C-reactive protein and lower blood pressure when compared to a cereal-based diet.23

A study published in 2002 compared reduction of type 2 diabetes with general lifestyle intervention versus with Metformin use. Metformin is a biguanide antihyperglycemic agent, and is also one of the medications our patient was taking upon entering our office. The lifestyle intervention involved achieving and maintaining a weight of at least 7 percent of initial body weight through a healthy diet and moderate-intensity physical activity such as brisk walking. The results of this study showed that the lifestyle intervention was more effective than Metformin use.24

There are a growing number of chiropractors offering nutritional counseling to patients in their practices. A pilot study published in 2007 aimed to determine the prevalence of nutritional counseling in chiropractic offices. Results indicate that 80% of chiropractors that responded are incorporating some form of nutritional counseling into their practices. More than 50% of the chiropractors reportedly address coronary artery disease, diabetes, obesity, allergies, and fibromyalgia with their counseling.25

Maximized Living

The patient in this case received what is known as Maximized Living care in our office. Maximized Living is a movement of chiropractors around the world with a mission to change the way people view and manage their health. It was established in 1999 in Celebration, Florida by Drs. Ben Lerner and Greg Loman. Maximized Living utilizes a model that includes core “essentials” necessary for good health. These essentials include a maximized mind, which encompasses areas such as time and stress management and overall peace and well-being; a maximized nerve supply, which encompasses a healthy, properly-aligned spine and nervous system using corrective techniques such as Pettibon; maximized quality nutrition based on a healing diet to help reduce inflammation in the body; maximized oxygen and lean muscle, which involves adequate amounts of proper exercise to decrease fat and increase lean muscle tissue; and minimized toxins, which involves reducing exposure to everyday toxins and eliminating accumulated toxins from the body.26

There is evidence in the literature that supports Maximized Living care as an effective intervention for improving health. A 2009 case study of a 4-year-old male patient with a learning disorder and speech delay who received Maximized Living care showed dramatic improvement in neurodevelopment after 44 visits. After the initial application of chiropractic adjustments to remove his subluxations, nutritional advice was provided for the patient to remove sugar and grains from the patient’s diet. Even after just one adjustment the patient began speaking and putting together full sentences and was able to recognize his written name for the first time.27

Another study published in 2010 measured the effects of Maximized Living care on a female patient with multiple sclerosis and GERD. Dramatic improvements in the patient’s symptoms related to multiple sclerosis were noted. After just 12 visits the patient reported improvement in pain levels, better mobility and improved lung capacity from 2610c.c. to 2700c.c. In addition to chiropractic adjustments, the patient received recommendations for a healing diet, specific types of surge training exercises, opportunities to attend peace-building and stress management workshops, as well as heavy metal testing. The patient implemented all recommendations, and at the end of her treatment plan the patient stated that she had an overall improvement in her health and wished to continue care.28

Conclusion

This patient presented with a long-standing history of type 2 diabetes mellitus, for which he took multiple oral medications daily. After receiving Maximized Living care in our office consisting of chiropractic adjustments and dietary modification for 36 visits, the patient was able to cease taking all medications and his plasma-glucose levels returned within a normal range. The patient’s x-rays began to show a return to normal after just 36 visits, as well as
his thermal and SEMG scans. His diabetes was resolved, as confirmed by his medical doctor three months after he began care. This case study is promising in that it provides diabetic patients with information about a non-invasive, non-toxic approach to restoring homeostasis within the body and normalizing plasma-glucose levels.

Limitations of this study include that only one diabetic chiropractic patient was studied. Further research is necessary on a larger scale to determine the effectiveness of chiropractic adjustments and dietary modification on a large population of diabetic patients. Another limitation to this study is that it did not isolate the individual effects of the chiropractic adjustments and the dietary modifications on this patient’s plasma glucose levels. Further research should attempt to measure these effects individually and separately.

References


FIGURE 1. Thermal scans: Initial thermal scan taken upon initial examination (A). Follow-up scans were taken at 12 visits (B), at 24 visits (C), and at 36 visits (D). Thermal instrumentation revealed consistent dysautonomia during the care intervals reported, with variable improvement noted in the thoracic and lumbar spine.
FIGURE 2. Static electromyography (SEMG) scans: Initial scan taken upon initial examination (A). Follow up scans were taken at 12 visits (B), at 24 visits (C), and at 36 visits (D). The most significant area of hypertonicity is seen in the upper cervical region. It is possible that the ongoing areas of hypertonicity in this area are related to muscle changes secondary to changes in cervical spine structure.
FIGURE 3. Initial AP Full Spine x-rays were taken upon initial examination (A). A follow-up post-film (B) was taken at 36 visits. Notice that the center of gravity line discrepancy improved from 7mm of deviation to 3mm of deviation (0mm is considered normal).

FIGURE 4. An initial lateral full-spine film was taken upon initial examination (A). A follow-up post-film was taken at 36 visits (B). The cervical lordosis of 35 degrees did not change (normal is 42 degrees). The atlas plan line improved from 24 degrees to 28 degrees (normal is 31 degrees). The patient initially had 23mm of anterior head carriage, which was reduced to 15mm (normal is 0mm).