

## CASE REPORT

# Management of pain due to cervical multilevel disk bulges and spinal stenosis with a focused vibro-percussion wave treatment: A case report

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## Abstract

A patient presenting with low back pain received 18 treatments of FDA-approved low-frequency vibro-percussion wave stimulation known as Khan Kinetic Treatment (KKT). Following KKT, he demonstrated improvement in pain, function, quality of life, sleep, and trunk range of motion with no adverse events.

## KEYWORDS

case report, KKT, low back pain, spinal stenosis, vibration therapy, vibroacoustic

## 1 | INTRODUCTION

Back pain is the leading cause of disability worldwide with up to 80% of the population experiencing back pain at some point in their life.<sup>1,2</sup> The cost of back pain in the United States of America (USA) alone is estimated to exceed \$50 billion per year.<sup>3</sup> Chronic back pain is complex, and various treatment options, ranging from conservative therapies to invasive surgery, exist for the management of these patients.<sup>4-7</sup> The Khan Kinetic Treatment (KKT) approach aims to provide orthopedic spinal treatment through focused vibro-percussion wave treatment and to manage the biomechanical aspect of back pain. Vibration treatment has been indicated for patients with a range of

musculoskeletal, neurological, and hemodynamic problems demonstrating positive changes in pain, spasticity, movement control, and specifically fatigue and anxiety in those with spinal cord or brain injuries.<sup>8-13</sup> The musculoskeletal effects specifically include stimulation of mRNA expression of proteins key to spinal health and a positive cellular environment for ligament repair.<sup>12</sup> KKT involves the application of low-frequency sine waves, within the audible spectrum, directed toward the spine as a vibropercussive wave. The low-frequency vibropercussive waves produce vibrations that cause delicate reverberations of the vertebrae, and minor repetitive stretching and activation of the attached soft tissues at multiple spine levels.<sup>14-16</sup>

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Treatments for chronic back pain should address psychosocial aspects of the condition, relieve pain, seek to improve spinal alignment, and help heal ligamentous structures. KKT addresses all of these factors. It specifically addresses the last three factors by (1) stimulating biosynthesis of intervertebral disks, (2) correcting abnormal mean axis of rotation of intervertebral joints, (3) activating spinal cord circuitry that “gates” pain transmission and reducing gamma motor neuron activity, (4) relaxing paraspinal muscles, ensuring that asymmetrical loads on the spine are minimized, and (5) increasing muscle coordination by decreasing pain which plays a critical role in spine stabilization.<sup>14,15</sup> Clinical evidence from published reports demonstrated that KKT relieves back and neck pain, corrects spinal alignment, and enhances the genetic expression of important proteins in the disks.<sup>14,15,17,18</sup> The following is a case report of a young patient who presented with both low back pain and neck pain, treated with KKT.

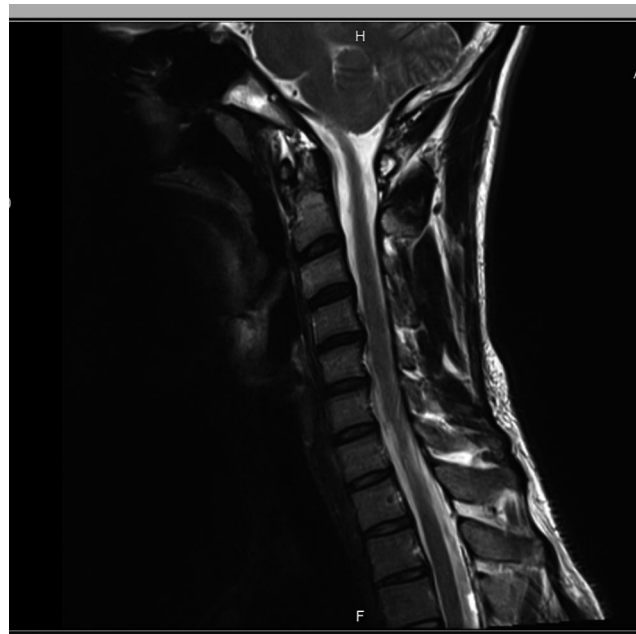
## 2 | PATIENT INFORMATION

A 23-year-old male healthcare worker presented with low back pain radiating to his right lower limb and neck pain radiating to both shoulders. His symptoms started three years prior to presentation and were aggravated by standing, sitting, walking, neck flexion, neck extension, and weightlifting. Upon presentation, he stated that the “pain is as bad as it could be.” He has had diabetes type I since childhood, taking insulin regularly. He had no history of osteoporosis or malignancy. Pain medications and conservative therapies did not improve his pain or sleep. Prior therapies included pregabalin, meloxicam, and celecoxib, and he complained of worsening symptoms following physical therapy and massage therapy. The patient provided his informed consent to publish the results of his treatment.

### 2.1 | Clinical findings and diagnostic assessment

On physical examination, the patient had severe tenderness over the lumbosacral and midthoracic spine, moderate limitation in trunk flexion and extension due to pain, decreased left side patellar reflex, and a positive straight leg raise (SLR) test on his right side.

The clinician conducted a series of physiological tests before each treatment: (1) cervical range of motion (ROM); (2) the shoulder and pelvic tilt angle determined to the quarter degree in the coronal plane with a set of calipers; (3) arm and leg coordinated response to resistance; (4) supine leg length discrepancy; and (5) deep spinal palpation



**FIGURE 1** MRI of the cervical spine before treatment showing bulging of the disk between the C3-C4 and C4-C5 regions

for the assessment of tender lesions. Depending on pre-treatment results, these tests were repeated immediately after each treatment application. On the initial examination, the patient had normal cervical ROM to the right and mild restriction to the left; the shoulder angle deviated to the left by one degree and the hip angle deviated to the left by 1.25 degrees; arm coordinated response to resistance was reduced on the left (3/5) and on the right (4/5) while legs were 3/5 bilaterally; leg length on the left side was 1cm shorter compared to the right; and the clinician found 13 tender lesions with considerable pain at various points along the spine.

The patient had magnetic resonance imaging (MRI) of the cervical spine and was diagnosed with cervical multi-level disk bulges with mild-to-moderate spinal canal stenosis (Figure 1). Other possible diagnoses considered were multilevel cervical spondylosis, cervical intervertebral disk degenerative disease with myelopathy, and muscle spasm. The patient had a Visual Analogue Scale (VAS) for pain score of 9.85/10, Neck Disability Index (NDI) score of 29/50 (58%), and Roland-Morris (RM) score of 8 points.

### 2.2 | Therapeutic intervention

The KKT device consists of a controller mounted on top of an impulse delivery mechanism, or device head, which in turn is mounted on a movable armature to a fixed stand.<sup>14,15</sup> The device head may be moved freely in three dimensions. At the base of the device head, there is a stylus used to deliver the sinusoidal wave forms of various

frequencies and intensities, which in this case ranged from 16 to 80 Hz (Figure 2). The device can be applied anywhere along the entire spine and related points at the discretion of the treating physician. Initial treatment parameters are created on basis of digital data captured through X-rays of the spine. The treatment plan for the patient was for 12 sessions of KKT on alternate days followed by six, once-weekly, follow-up sessions, along with physician-recommended lifestyle modifications. Although the patient had severe tenderness over the lumbosacral and midthoracic spine, limitation in trunk flexion and extension due to pain, and MRI showed cervical multilevel disk bulges, KKT clinical experience has repeatedly shown that a shifted C1 can result in misalignment along the spine causing disk bulging, pain at multiple locations, and changes in function. Consequently, treatment began with C1. Table 1 indicates the anatomical locations at which treatment was administered and the number of pulses used during each treatment session. The patient was largely compliant with the 12 treatment schedule, but the first follow-up treatment was delayed by almost two months.

The patient completed the VAS for pain after every six sessions, while the NDI and RM questionnaire were recorded at the initial session and after the final follow-up session.

### 2.3 | Follow-up and outcomes

Following the first KKT treatment, the patient's experienced immediate normalization of his left patellar reflex, trunk flexion, and trunk extension. He also experienced

improvement of pain outcomes. From the 13 painful tender lesions at intake, these were reduced to 5 by treatment 7 and to 0 by treatment 12. The patient's VAS pain score reduced from 9.85 at intake to 3.51 by the final treatment session and 4.48 at the final follow-up session. His NDI score reduced to 11/50 (22%) by the final follow-up session, and his RM score reduced to 6 points. The patient stated that there was a noticeable improvement in his quality of life and sleep, and that he could now perform better at work due to his improvement in physical activity and reduced pain. It is noteworthy that the patient had a few relapses because of excessive workloads and because he did not always adhere to his doctor's recommendations.

Along with improved symptoms, there was also a notable correction in the biomechanics of his spine and body. Shoulder and pelvic tilts steadily improved with KKT treatment until it became neutral from the 5th treatment onwards. After the 7th treatment, the patient had full cervical ROM. After completing his treatment sessions, MRI imaging showed resolution of cervical disk bulging. After reviewing all the MRI slices, the orthopedic surgeon noticed improvement in disk hydration in all cervical spine disks, a reduction in spine cord compression at levels C4-C5 and C5-C6, and no stenosis in the cervical spine (Figure 3). The patient did not experience any adverse events related to the treatment.

### 3 | DISCUSSION

The management of chronic back pain is complex and continues to be a leading cause of disability and productivity loss worldwide.<sup>1,2,5</sup> Treatment can include

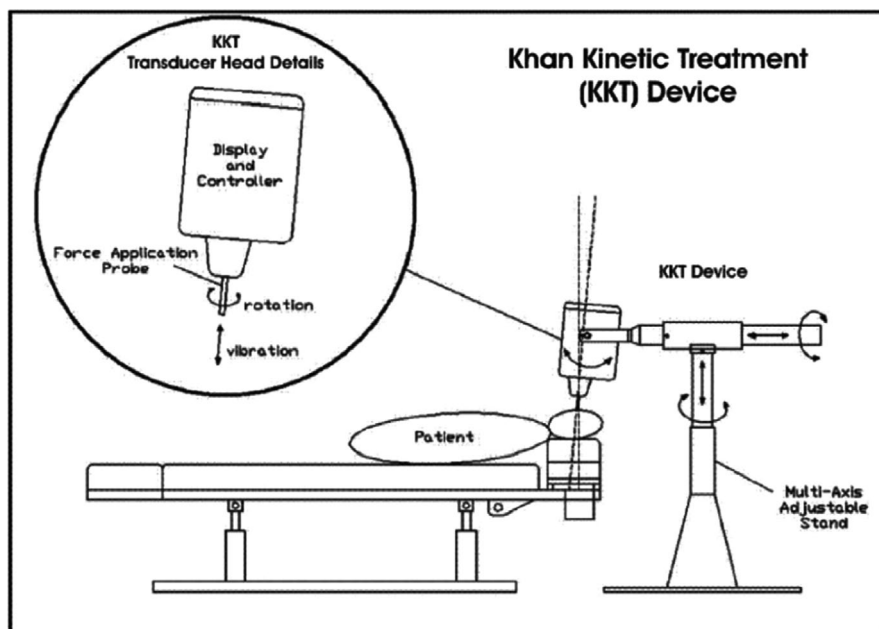


FIGURE 2 KKT device

TABLE 1 Location and number of treatment pulses<sup>a</sup>

Tx#	Treatment location and # of pulses				
	Cervical	Sternum	Thoracic	Lumbar	Sacrum/Iliac
1	Lft C1 80				
2	Lft C1 80				
3	Lft C1 80				
4	Lft C1 80	60			
5	Lft C1 80	Lft Sc 60		L5 <sup>b</sup> 60	
6	C1 80 C5 <sup>b</sup> 40	60			
7	C5 <sup>b</sup> 40				S3 <sup>b</sup> 60
8	C5 <sup>b</sup> 40	60; Rt Sc 60			
9		60	T3 <sup>b</sup> 60	L5 <sup>b</sup> 60	
10			T4 <sup>b</sup> 60; T5 <sup>b</sup> 60		Rt PSIS 80; PIIS 80
11			Lft T4 60		Rt S1 60; Rt PSIS 80
12			Lft T4 60; T5 <sup>b</sup> 60		S1 <sup>†</sup> 60; Rt PSIS 80
<b>Periodic follow-up treatments beginning 8 weeks following treatment 12</b>					
1	Lft C1 80		T5 <sup>b</sup> 60		Rt S1 60, S5 60
2	Lft C1 80	60		L5 <sup>b</sup> 60	Rt PSIS 60
3	Lft C1 80 C5 <sup>b</sup> 40 C7 <sup>b</sup> 40			L5 <sup>b</sup> 60	Rt PSIS 80
4	Lft C1 80	60; Rt Sc 60; Lft Sc 60		L5 <sup>b</sup> 60	
5	Lft C1 80	60; Rt Sc 60		L5 <sup>b</sup> 60	Rt PSIS 80
6	Lft C1 80	60; Rt Sc 60			S1 <sup>b</sup> 60; Hypogastrium 60

Abbreviations: Lft=left; PIIS =Posterior inferior iliac spine; PSIS =Posterior superior iliac spine; Rt =right; Sc =sternoclavicular; Tx =Treatment.

<sup>a</sup>Each pulse lasts about 3 seconds including the frequency reset.

<sup>b</sup>Midline.

a combination of various medical, psychological, and physical therapies. After these conservative options fail, more invasive and irreversible surgical intervention may then be offered to certain patients as a last resort, for those who qualify.<sup>4-7</sup> However, spine surgery does not guarantee long-term symptomatic relief, patient satisfaction, or return to daily living and is associated with complications, highlighting the need for less invasive treatment options.<sup>19-21</sup>

The KKT approach can fulfill this unmet need by treating patients by means of precisely directed vibropercussive sound stimulation. The current case study of a young patient who presented with both low back and neck pain treated with KKT is consistent with the previously published evidence.<sup>14,15,17,18</sup> After completion of his sixth maintenance session, the patient exhibited improvements in pain and disability scores, trunk range of motion, quality of life, sleep, and work performance with no reports of adverse effects. Documented improvement in cervical spine stenosis was noted on MRI. A limitation of this case

must be noted in that it cannot report the long-term effect of the treatment beyond the last treatment given.

The use of focused low-frequency vibropercussive waves in the treatment of spinal pathologies is a novel medical development, which has been largely spearheaded by the KKT clinical and scientific teams. This treatment is currently provided in 23 clinics in 10 countries. This particular case is notable as, in addition to improvement in symptoms and quality of life, positive changes were also seen on MRI following KKT in a short time period. This case demonstrates the substantial physiological effect rhythmically pulsed spinal stimulation therapies including sound waves can play in the nonsurgical management of patients with spinal pathologies. Although repetitively pulsed electrical stimulation has demonstrated some promising results in the literature in patients with lumbar spinal stenosis,<sup>22,23</sup> less has been reported with vibropercussive sound wave stimulation. A greater understanding of the physiological changes that happen to the spine and its surrounding structures



**FIGURE 3** MRI of the cervical spine after treatment revealing no stenosis in the cervical spine

during vibropercussive wave treatment is needed. The current RCT evidence on KKT has demonstrated significantly improved pain and functional outcomes compared to controls in patients with chronic neck or low back pain.<sup>14,15,18</sup> More specially, one of the earliest studies looking at the clinical effects of this device showed that patients with chronic back and neck pain receiving the treatment compared to the non-treatment control group experienced significant improvement in pain scores ( $p < .001$ ) and a decrease in pain medication requirements ( $p = .05$ ).<sup>18</sup> A second study compared a treatment group to sham treatment and found that KKT treatment improved pain ( $p = .011$ ) and neck disability scores ( $p = .009$ ).<sup>14</sup> Follow-up studies showed that the waves induced beneficial mechanical changes in the vertebrae, restoring the vertebral column to a more natural alignment. The KKT treatment corrected 62 percent of abnormal mean axes of rotation (MAR) with significantly larger MAR vector magnitude differences [pre-post] at the C5-6 level than shams.<sup>14</sup> Subsequent studies investigated possible cellular changes induced by the waves. Animal studies on bovine intervertebral disks showed that waves from the KKT device induced upregulation of matrix protein mRNA, such as aggrecan and collagen type II.<sup>17</sup> All of these proteins are associated with disk hydration and disk health. Continued large-scale studies on the use of KKT for this indication will assist in validating these findings.

## 4 | CONCLUSION

The KKT approach demonstrates promising results, with limited safety concerns, in a young patient diagnosed with cervical multilevel disk bulges with mild-to-moderate spinal canal stenosis. The patient experienced symptomatic relief and, as a result, improved quality of life and work performance. Positive structural changes were also seen on MRI. His improvement is consistent with multiple randomized control trials showing benefits of the KKT treatment.

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## CONFLICTS OF INTEREST

All of the authors conducted this study in the normal course of their work related to KKT International and Neuro Spinal Innovations (NSI). They received no additional remuneration, and any benefits to KKT or NSI will not affect this.

## AUTHOR CONTRIBUTIONS

Arwa Jameel Abu Omar, involved in primary treating clinician, gathering data, reviewing manuscript, and final approval. Mohammad Sami Al Baradie, MSc involved in treating clinician, gathering data, reviewing manuscript, and final approval. Hussain Al Dera, involved in coordinating selection of the case, reviewing draft of paper, interpreting data, and final approval. Christopher Vannabouathong, involved in drafting the manuscript, incorporating author suggestions, interpreting data, and final approval. Lee Bartel, involved in concept of paper, creating data set and descriptions for original draft, revisions, and final approval.

## ETHICAL APPROVAL

As a single case report with the patients signed consent, no other ethical review was required.

## CONSENT

The patient signed a consent to publish the paper after reviewing it.

## DATA AVAILABILITY STATEMENT

All basic clinical data have been reported. Physiological assessment data for all treatments and initial cervical

X-rays are available upon request from the corresponding author.

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