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Effectiveness of KIASTM technique applied only quadriceps muscle for knee pain

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Abstract
Background: It is believed that knee pain results from factors that may be biological and/or psycho-social in origin. Among biological factors, data suggest that quadriceps muscle weakness may contribute to worsening of knee pain. Recent investigations have provided evidence that higher quadriceps strength may inhibit worsening of knee joint structure.
Objective: To study the effectiveness of strengthening exercise with and without the use of K-IASTM tool in reducing knee pain.
Methods: 30 samples will be divided into two groups – Group A- K-IASTM and strengthening exercises; Group B- strengthening exercises. Subjects will be selected by alternative systematic random sampling method based on inclusion and exclusion criteria along with a written consent form which will be taken from the participants. K-IASTM will be done on Quadriceps muscle using scanning, combing, scouring and gliding technique for 90 seconds- 2 minutes on each muscle.One-way ANOVA were used to determine the statistical significance of the quadriceps strength, related ratios, knee joint passive stiffness, and pain threshold in each technique. The significance level was set at $\alpha = 0.05$.
Results: The IASTM group showed greater improvement in the peak quadriceps strength (p value <0.001), the significant decrease in VAS score was observed ($p<0.05$) and it was found the reduction in VAS score was highest of IASTM as compared to group B.
Conclusion: The present comparative study provided first clinical evidence that IASTM technique is a best soft tissue mobilization technique to improve the strength, associated strength ratio, knee joint passive stiffness, and pain threshold among individuals with Quadriceps weakness.

Keywords: Quadriceps shortness, muscle strength, soft tissue mobilization, stiffness

Introduction

Prevalence rate in India

In India due to reduced physical activity in population will increase the risk of early occurrence OA knee. Prevalence of osteoarthrosis of knee was 21.6% among women in the age group was 30-60 years. The prevalence rate of the OA knee increases with the age. Prevalence was higher in menopausal women due to hormonal changes. Sedentary lifestyle and higher BMI also emerged as the common factor which cause OA knee (Kaur *et al*. 2018) [16]. In India, OA knee affects all the age groups, but after the age of fifty years the prevalence increases dramatically (Maurer *et al*., 1979: Meulen belt 1997) [17, 18]. OA ranks fourth among medical problems in women (Shammari *et al*., 1995: Arfaj 2 *et al*., 2002) [19, 20]. So clinically men had lower risk of OA knee than the women. In India, the prevalence rate is estimated to be 17–60.6% (Sharma *et al*., 2007) [21].

Causes for osteoarthrosis of knee

Osteoarthrosis is said to be world's leading causes of immobility and is defined as degeneration of subchondral bone and articular cartilage in joint spaces (Allen *et al*., 2015). Primary cause for OA knee is obesity, repeated strain to weight bearing structures. The OA mainly affects the weight bearing joints such as knee. The knee will have so many alteration of force pattern in the muscle biomechanics during the daily events of the day (Vincent *et al*., 2012) [22]. The world health organization reported that the prevalence of the OA was 18% in elderly men and 9.6% in elderly female (Woolf *et al*., 2003). Biomechanically increased obesity and inactive physical activity are the risk factor for prevalence of OA knee

(Marshall *et al*., 2015) [23]. OA knee will create burden on future health problems among Indian population in modern health scenario. The female gender other than the age and weight have the high risk because of menopause, genetics, poor diet, joint overuse and muscle weakness (Ashkavand *et al*., 2013: Palazzo *et al*., 2016) [24, 25]. Pathophysiology of OA remains to be elucidated. Altered joint loading and metabolism of the cartilage are the main reason for the cartilage degradation and OA knee (Guilak *et al*., 2011) [26]. OA knee has the clinical presentation of pain, swelling, limitation of movement, tenderness of medial joint line and inflammation (Kraus *et al*., 2015) [27].

Muscle dysfunction in Osteoarthrosis

The muscle strength of the hip abductor and adductor are biomechanically important for reduction in moment arm of knee adduction (Chang *et al*., 2005) [28] during single limb stance. During walking the stabilization of pelvis on the hip joint in the frontal plane in against gravity, the hip abductor and adductor muscle recruitment is required. The weakness of the hip abductors in the ipsilateral will tend to drop the pelvis in the contralateral side which will shift the center of gravity of the body away from the knee joint and it causes increased adduction arm moment in hip joint. This is one of the clinical reasons to alter the mechanical axis of knee joint. The muscle which is impaired in the OA knee is quadriceps femoris when compared to the healthy individuals. (Cheing *et al*., 2001: Berth *et al*., 2002: Diracoglu *et al*., 2009) [29, 30]. The quadriceps muscle will have weakness due to the activation deficit and atrophy of the quadriceps muscle. Individuals with OA knee will have weakness of hamstring muscle along with the quadriceps muscle (Emrani *et al*., 2006: Costa *et al*., 2010) [31, 32]. A recent study has compared the muscle strength of the hip in the participants with symptomatic OA knee and the asymptomatic OA knee. Study reveals that there is weakness in the hip abductors, hip adductors, and hip internal and external rotators. The author has given a recommendation that the hip strengthening should be done during the rehabilitation of the OA knee (Rana *et al*., 2010) [33].

Joint position sense in osteoarthrosis

Joint position sense (Proprioception) declines with aging and this decline is not simply the consequence of subclinical OA. Knee position sense is very poor in OA knee. Clinically participants with OA knee have shown reduced muscle strength, proprioception and balance (Latham *et al*., 2010) [36]. Muscle strength of the thigh muscle will reduce along with the limitation of the walking ability and dynamic balance in participants with OA knee (Van der Esch *et al*., 2007) [34]. The intervention group exercises was 930 steps of forwards/backwards alternate 930 mini squats, 930 side stepping and control group exercises was 930 static quadriceps exercises (5 sec hold; 10sets). Both programmes were carried out for 4 weeks. Progressive kinesthesia, balance and strengthening exercises including modified Rhomberg exercise, retro walking, walking on heels/toes, rocker board and one leg standing used to improve proprioception and balance in OA knee. Conventionally weight bearing strengthening exercises, static bike riding, isometric hamstring, quadriceps and abductor exercises, isotonic resisted quadriceps and hamstring exercises (10 reps of maximal weight, 1 set) also used to intervention for proprioceptive and balance training for OA knee. In addition all patients received information about OA knee and joint protection. The recommended dosage for above exercise is 3 days in a week under the guidance of the physiotherapist for 8 weeks (Chaipinyo *et al*., 2009) [35].

Need for the study

The National Institute for Clinical Excellence (NICE) report, in the 2014 guidelines, that treatment for osteoarthrosis should take a holistic approach. This should have education along with non-pharmacological treatment like exercise, weight loss and some assistive devices such as knee braces and cane. Surgical treatments include the total knee replacement, noncompartmental knee arthroplasty and tibial osteotomy. They are cost effective treatments for osteoarthrosis. There are evidences that these surgical treatments are not effective for the young people with OA knee because they have a very active lifestyle and post operative can cause much complication. Hip joint muscle strength has a critical role in balancing the lower extremity in single limb stance. During heel strike, gluteus medius contract and create lateral tilt on opposite side pelvis to maintain center of gravity in a level position. Clinically quadriceps Weak thigh muscle will cause impaired walking and balance and leads to risk of fall during activities of daily living. So pain, lower extremity muscle power and proprioception are clinically important for participants balance control. Hence there is a need to study K-IASTM exercise to QUADRIECPES in various balance strategies to achieve muscle strength, joint position sense, balance and activity of daily living.

K-IASTM is a simple, non-invasive form of manual therapy to manipulate or mobilize soft tissue structures of the human body. It is becoming increasingly popular these days among practitioners and patients alike due to its remarkable safety and efficacy profile. It can be applied either alone or in conjunction with supplementary exercises and additional modalities.

It is based upon the concept of deep friction massage as proposed be Cyriax and Russell (1980) [37]. It was designed by Kinesio Prehab Institute. The most widely accepted origin of IASTM is Gua Sha, form of traditional Chinese medicine [11].

It is based on micro trauma and fibroblastic activity which adheres to affected soft tissue structure and causes local inflammatory response. It causes reabsorption of inappropriate fibrosis and facilitates a cascade of healing activities results in remodeling of adhered soft tissue structures [11].

OA is a whole person condition in which different biopsychosocial factors that modulate inflammatory processes as well as behavioral responses which trigger pain and disability interact to affect a person's joint health.

K-IASTM has emerged as a popular alternative to traditional manual therapy techniques. It facilitates the healing process through increased fibroblast proliferation, increased collagen synthesis, maturation and alignment.

Because individuals with OA, avoid physical activities that exacerbate symptoms potentially increases risk of cardiovascular disease, relationship between these also has to be considered.

Aim of the study

To study the effectiveness of strengthening exercise with and without the use of K-IASTM tool in reducing knee pain

Methodology

Source of Data: A sample of 30 individuals were taken from Geetanjali Medical College and Hospital; outpatient

department which are eligible as per inclusion and exclusion criteria.

Study Duration: 12 week
Sampling Technique: A convenient sampling technique is used for data collection.
Sample Size: 30 subjects.

Inclusion criteria

1 **Age group:** >18 years.
2 **Gender:** Both male and female.
3 Obese patients (BMI more than 30).
4 Patient with walking aids.
5 Patients with primary osteoarthritis

Exclusion criteria

1 Those who are not fulfilling the criteria.
2 Those who refuse for the consent form.
3 Preexisting Respiratory condition (COPD, asthmatic).
4 Hypothyroidism.
5 Patients on blood thinners.
6 Varicose veins.
7 Open wound.
8 Infection.
9 Neurological diseases.
10 Autoimmune diseases.
11 Subjects with history of lower extremity injury in past 3 months.
12 Any recent knee reconstructive surgery.

Procedure

30 samples will be divided into two groups – Group A- K-IASTM and strengthening exercises; Group B- strengthening exercises. Subjects will be selected by alternative systematic random sampling method based on inclusion and exclusion criteria along with a written consent form which will be taken from the participants. Firstly, pre-participation data will be collected which will include details like name, age, sex, occupation, BMI, medications etc. will be collected and documented. After exercise intervention, values of all parameters of the sessions will be recorded in data collection sheet and master chart will be prepared for statistical analysis.

- K-IASTM will be done on Quadriceps muscle using scanning, combing, scouring and gliding technique for 90 seconds- 2 minutes on each muscle.
- Strengthening exercises will be:

1. Isometrics- Quadriceps – Hamstring.
2. Straight Leg Raise (supine, side-lying).
3. Eccentric hamstring lengthening.
4. VMO strengthening.
5. Q-Drills.

Pre and post intervention data will be collected based on following outcome measures

- **VAS (Visual Analogue Scale):** The Visual Analogue Scale (VAS) consists of a straight line with the endpoints defining extreme limits such as 'no pain at all' and 'pain as bad as it could be'. The patient is asked to mark his pain level on the line between the two endpoints. The distance between 'no pain at all' and the mark then defines the subject's pain.

Result

At 12th week, mean VAS score among group A, B was 2.9 ± 0.79, 2.71 ± 0.78 respectively. It was observed there was significant difference in VAS score at 12th week among different groups and it was lowest in Group of IASTM as compared with other groups (p value <0.05) On the other side, among Group A (F value = 93.58, p value <0.001) B (F value = 148.57, p value <0.001), the significant decrease in VAS score was observed (p<0.05) and it was found the reduction in VAS score was highest of IASTM as compared to group B.

Table 1: Pre and post mean vas score among groups

Vas	Group A Kiastm		Group B		P Value
	Mean	SD	Mean	SD	
Pre	6.05	0.90	6.20	1.05	<0.001
12th Week	2.4	0.70	2.6	0.98	

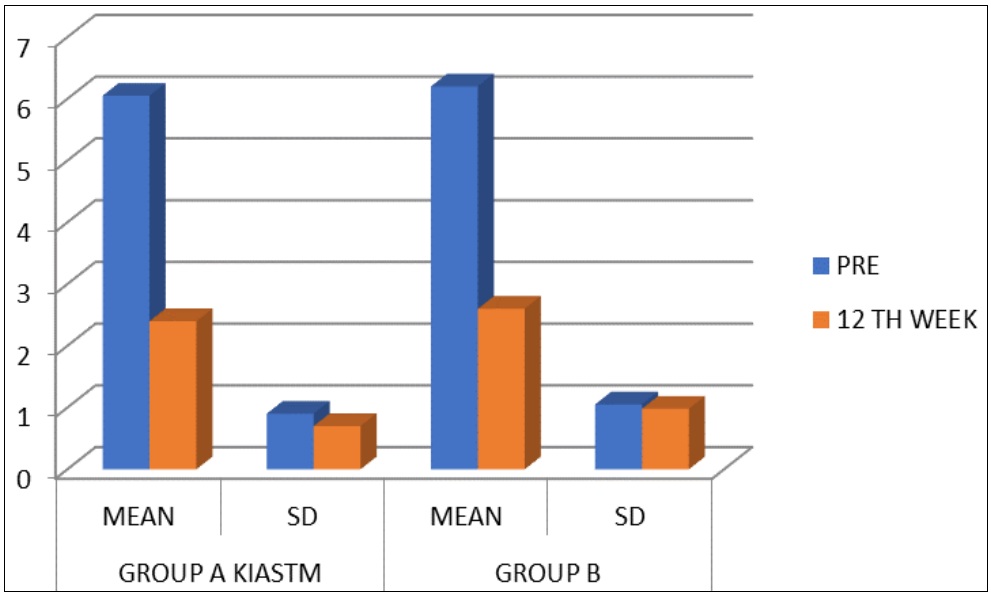

Fig 1: Pre and post mean vas score among groups

Discussion

IASTM refers to a technique that uses an instrument to remove scar tissue that had formed in soft tissues and assists in the healing process by activating fibroblasts. IASTM is simple and practical and requires only a short period of time for a single treatment. According to previous studies, IASTM was found to improve soft tissue function and ROM in acute or chronic sports injuries to soft tissues, while also reducing pain. IASTM and kinesio tape in a 12-week rehabilitation program and applied it to patients who had undergone anterior cruciate ligament surgery. The results showed recovery of muscle strength and ROM of the lower extremity without any complications and a drastic reduction in pain, which enabled the patients to return to their activities of daily living and sports. Therefore, clinically, the application of kinesio tape immediately following IASTM can assist the function of weakened muscles during stretching and muscle strengthening exercises, which can be useful during the rehabilitation process.

The objective of study was to find the instrument assisted soft tissue mobilization on pain and functional disability in subjects with knee pain and compare these findings with conventional exercises. In the present study statistically significant improvement in pain based on NPRS score within study group who received IASTM with conventional exercises and control group who received only exercises. Between the groups analysis found that there is statistically significant difference in improvement of pain and functional disability however the greater percentage of improvement was found in both the group who received instrument assisted soft tissue mobilization compared with conventional exercises.

The possible physiology of reduction in pain and improved range of motion may be due to the following reasons, IASTM is a technique that involves using instruments to address musculoskeletal pathology-related impairments and help heal soft tissues. When a stimulus is applied to the injured soft tissue using an instrument, the activity and the number of fibroblasts increase, along with fibronectin, through localized inflammation, which then facilitates the synthesis and realignment of collagen is one of the proteins that makes up the extracellular matrix. When the scar tissue is removed by IASTM, functional normalization around the soft tissue can be achieved (Black, 2010). Microvascular and capillary hemorrhage, along with localized inflammation, can occur as a result of using IASTM to apply appropriate pressure and shear force to the soft tissue. Such inflammation restarts the healing process by removing the scar tissue and releasing adhesions, while also increasing blood and nutrient supply to the injured area and migration of fibroblasts. The result of this led to inference that instrument assisted soft tissue mobilization is effective in reducing pain and functional disability in subjects with knee pain syndrome, when given with proper dosage. Numerous studies have come up with effective instrument assisted soft tissue mobilization is effective in reducing pain and functional disability in subjects with knee pain. It would be useful to determine the long term effectiveness of such interventions in future studies. The result of this study may be applied to a population with knee pain.

Conclusion

IASTM refers to a technique that uses an instrument to remove scar tissue that had formed in soft tissues and assists in the healing process by activating fibroblasts. IASTM is simple and practical and requires only a short period of time for a single treatment. IASTM was found to improve soft tissue function and ROM in acute or chronic sports injuries to soft tissues, while also reducing pain the present comparative study provided first clinical evidence that IASTM technique is a best soft tissue mobilization technique to improve the strength, associated strength ratio, knee joint passive stiffness, and pain threshold among individuals with Quadriceps weakness.

Conflict of Interest

Not available

Financial Support

Not available

References

1. Arnab Chandra, Sharad KS, Anwer Shahnawaz, Siddhartha Shankar Sikdar. A study on the efficacy of patellar taping for knee osteoarthritis as compared to conventional physical therapy. IJCRR. 2012;4(22):91-98
2. Michelle J, Lespasio JD, Nicolas Piuzzi S, Elaine Husni M, George Muschler F, Guarino AJ, Michael Mont A. Knee Osteoarthritis: A Primer. The Permanente Journal, 2017, 16-183.
3. Ashraf Ramadan Hafez, Aqeel Mohammed Alenazi, Shaji John Kachanathu, Abdulmohsen Meshari Alroumi, Elham Saed Mohamed. Knee Osteoarthritis: A Review of Literature. Austin publishing group. 2014;1(5):1-8.
4. Haq Murphy E, Dacre J. Osteoarthritis. postgrad med J, 2003, 377-383.
5. Haibin Wang, *et al.* Effects of exercise therapy for knee osteoarthritis Int J Clin Exp Med. 2018;11(9):10009-10014.
6. Ganesh B, Ayman Pathan, Allen Tiwade. Short term effects of instrument assisted soft tissue mobilization on pain and activities of daily living in subjects with patellofemoral joint osteoarthritis: A randomized controlled trial. Int. J Curr. Res. Med. Sci. 2017;3(11):55-63.
7. Brandon Behara, Bert Jacobson H. Acute Effects of Deep Tissue Foam Rolling and Dynamic Stretching on Muscular Strength, Power, and Flexibility in Division I Linemen J Strength Cond Res. 2017 Apr;31(4):888-892.
8. Gay C, Chabaud A, Guilley E, Coudeyre E. Educating patients about the benefits of physical activity and exercise for their hip and knee osteoarthritis. Systematic literature review. Annals of physical and rehabilitation medicine. 2016 Jun 1;59(3):174-83.
9. Nicole MacDonald, *et al.* the effects of instrument assisted soft tissue mobilization on lower extremity muscle performance: a randomized controlled trialnt J Sports Phys Ther. 2016 Dec; 11(7):1040-1047.
10. Goran Markovic Acute effects of instrument assisted soft tissue mobilization vs. foam rolling on knee and hip range of motion in soccer players J Bodyw Mov Ther. 2015 Oct;19(4):690-696.
11. Gillian Hawker A. *et al.* All-Cause Mortality and Serious Cardiovascular Events in People with Hip and Knee Osteoarthritis: A Population Based Cohort Study PLoS One. 2014;9(3):e91286.
12. Taciano Rocha, *et al.* Effects of diaphragm release manual technique on diaphragm mobility, chest Wall kinematics and functional exercise capacity of COPD patients European Respiratory Journal. 2013;42:3165.
13. Loghmani MT, Whitted M. Soft Tissue Manipulation: A

Powerful Form of Mechanotherapy. Physiother Rehabil. 2016;1(122):2.
14. Loghmani MT, Bane S. Instrument-assisted soft tissuemanipulation: evidence for its emerging efficacy. J Physiother S. 2016 Nov;3:2.
15. James R. Scifers, Russell Baker, Alison Gardiner Shires, PhillipVardiman, Instrument Assisted Soft Tissue Mobilization. Athletic Training and Sports Health Care March/April 2017;9(2):49-52.
16. Kaur G, Arora S. Chaotic whale optimization algorithm. Journal of Computational Design and Engineering. 2018 Jul 1;5(3):275-84.
17. Maurer H, Zowe J. First and second-order necessary and sufficient optimality conditions for infinite-dimensional programming problems. Mathematical programming. 1979 Dec;16:98-110.
18. Meulenbelt I, Bijkerk C, De Wildt SC, Miedema HS, Valkenburg HA, Breedveld FC, Pols HA, Te Koppele JM, Sloos VF, Hofman A, Slagboom PE. Investigation of the association of the CRTM and CRTL1 genes with radiographically evident osteoarthritis in subjects from the Rotterdam study. Arthritis & Rheumatism. 1997 Oct;40(10):1760-5.
19. Al-Shammari SA, Khoja T, Al-Yamani MJ. Compliance with short-term antibiotic therapy among patients attending primary health centres in Riyadh, Saudi Arabia. Journal of the Royal Society of Health. 1995 Aug;115(4):231-4.
20. Al-Arfaj A, Al-Boukai AA. Prevalence of radiographic knee osteoarthritis in Saudi Arabia. Clinical rheumatology. 2002 May;21:142-5.
21. Sharma RK, Agrawal M, Marshall F. Heavy metal contamination of soil and vegetables in suburban areas of Varanasi, India. Ecotoxicology and environmental safety. 2007 Feb 1;66(2):258-66.
22. Vincent EM, Lengaigne M, Vialard J, Madec G, Jourdain NC, Masson S. Assessing the oceanic control on the amplitude of sea surface cooling induced by tropical cyclones. Journal of Geophysical Research: Oceans. 2012 May;117(C5).
23. Marshall SW, Guskiewicz KM, Shankar V, McCrea M, Cantu RC. Epidemiology of sports-related concussion in seven US high school and collegiate sports. Injury epidemiology. 2015 Dec;2(1):1-0.
24. Ashkavand Z, Malekinejad H, Vishwanath BS. The pathophysiology of osteoarthritis. Journal of Pharmacy Research. 2013 Jan 1;7(1):132-8.
25. Palazzo C, Nguyen C, Lefevre-Colau MM, Rannou F, Poiraudeau S. Risk factors and burden of osteoarthritis. Annals of physical and rehabilitation medicine. 2016 Jun 1;59(3):134-8.
26. Guilak F. Biomechanical factors in osteoarthritis. Best practice & research Clinical rheumatology. 2011 Dec 1;25(6):815-23.
27. Kraus VB, Blanco FJ, Englund M, Karsdal MA, Lohmander LS. Call for standardized definitions of osteoarthritis and risk stratification for clinical trials and clinical use. Osteoarthritis and cartilage. 2015 Aug 1;23(8):1233-41.
28. Chang C, Wang YF, Kanamori Y, Shih JJ, Kawai Y, Lee CK, Wu KC, Esashi M. Etching submicrometer trenches by using the Bosch process and its application to the fabrication of antireflection structures. Journal of micromechanics and microengineering. 2005 Jan 13;15(3):580.
29. Cheing GL, Hui-Chan CW. The motor dysfunction of patients with knee osteoarthritis in a Chinese population. Arthritis Care & Research: Official Journal of the American College of Rheumatology. 2001 Feb;45(1):62-8.
30. Berthet C, Guéhenneux F, Revol V, Samarut C, Lukaszewicz A, Dehay C, Dumontet C, Magaud JP, Rouault JP. Interaction of PRMT1 with BTG/TOB proteins in cell signalling: molecular analysis and functional aspects. Genes to Cells. 2002 Jan;7(1):29-39.
31. Al-Emrani M, Kliger R. Analysis of interfacial shear stresses in beams strengthened with bonded prestressed laminates. Composites Part B: Engineering. 2006 Jun 1;37(4-5):265-72.
32. Costa I, Ferrão P. A case study of industrial symbiosis development using a middle-out approach. Journal of Cleaner Production. 2010 Jul 1;18(10-11):984-92.
33. Rana D, Matsuura T. Surface modifications for antifouling membranes. Chemical reviews. 2010 Apr 14;110(4):2448-71.
34. Van der Esch M, Steultjens M, Harlaar J, Knol D, Lems W, Dekker J. Joint proprioception, muscle strength, and functional ability in patients with osteoarthritis of the knee. Arthritis Care & Research: Official Journal of the American College of Rheumatology. 2007 Jun 15;57(5):787-93.
35. Chaipinyo K, Karoonsupcharoen O. No difference between home-based strength training and home-based balance training on pain in patients with knee osteoarthritis: A randomised trial. Australian Journal of Physiotherapy. 2009 Jan 1;55(1):25-30.
36. Bahrami B, Olsen K, Latham PE, Roepstorff A, Rees G, Frith CD. Optimally interacting minds. Science. 2010 Aug 27;329(5995):1081-5.
37. Robson HE. J Cyriax G. Russell. Textbook of Orthopaedic Medicine. 2-Treatment by Manipulation and Injection. British Journal of Sports Medicine. 1980 Dec;14(4):236.

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