Effect of Kinesio-Taping on pain and muscle activity in individuals with Bruxism

Dr. Manisha Rathi (Ph.D.)¹, Dr. Nidhi Keniya², Dr. Tushar J Palekar³
¹ Professor, ² Resident, ³ Principal
Dr. D. Y. Patil College of Physiotherapy, Dr. D. Y. Patil Vidyapeeth, Pimpri, Pune

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Abstract

**Background:** Bruxism, habit of excessive teeth grinding/clenching or teeth tightening, leads to teeth-wear, increased masticatory muscles’ firing, pain, temporomandibular joint dysfunction, headache, sleep disturbances, etc. Kinesio-Taping (KT) works with body, allowing full movement, reduces pain and enhances muscle activity. This study investigated effect of KT on pain and muscle activity of masseter in individuals with Bruxism. **Aim:** To find effect of KT on Pain and Muscle activity in Experimental Group and compare it with Controls. **Setting and Study Design:** This randomized controlled trial was carried out at Dr. D. Y. Patil College of Physiotherapy, Pune. **Methods and Materials:** 30 individuals between 18-45 years, both genders, diagnosed with Bruxism were randomly divided in Experimental and Control Groups. NPRS and surface EMG (sEMG) were recorded (P1). The Experimental Group received KT for masseter which was retained for 24hrs. Control Group did not receive KT. NPRS and sEMG were assessed after 24hrs (P2), and after 48hrs (P3) to assess carryover effects. NPRS and EMG (P2 and P3) were taken for control group too. **Results:** Experimental Group showed statistically significant difference in NPRS and sEMG at 24hrs (P2) and 48hrs post-treatment (P3) when compared to Baseline (P1) and Control Group (p<0.001). **Conclusion:** KT significantly improved Pain and Masseter muscle activity in individuals with Bruxism, with significant carryover effect post tape removal.

**Key Words:** Bruxism, Clenching, EMG, Kinesio-Taping, NPRS.

Introduction:

Bruxism, which is a parafunctional habit, is characterized as a contact of the teeth which is non-functional (¹). In 2014, Bruxism was defined by the American Academy of Sleep Disorder as a disorder in which jaw muscles’ activity occurs repetitively, manifesting as clenching/teeth grinding, also by bracing/thrusting of the mandible (²).

Bruxism is a habit of grinding teeth excessively, clenching/teeth tightening. This can happen when individual is awake and it's called awake bruxism and when occurring during sleeping it's called sleep bruxism. International Classification of Sleep Disorders describes Bruxism as a movement disturbance relating to sleep, seen as contraction of the masticatory muscles, which results in teeth grinding or teeth clenching (³).
Prevalence of awake bruxism is 20% and that of sleep bruxism is 8% in adults. Sleep bruxism seems to decline over time. It’s seen to change from 14% in children to 8 in adults and 3% in patients over the age of 60 \(^4\). A correct diagnosis depends on self-reported habit of clenching/grinding of teeth, masticatory muscle pain, use of questionnaires, clinical evaluation of occlusion and dentition, musculature, habits and quality of sleep, observation of attrition including a routine examination by the dentist for finding other related signs and symptoms \(^2\).

Bruxism is known to have varied etiology. Central dopaminergic and serotonergic systems have prime importance in physiopathology of sleep bruxism with altered jaw movements occurring during sleep. Oral habits, malocclusion, hypopnea, high anxiety levels, temporomandibular dysfunction, and stress may influence its peripheral occurrence \(^6\). The relation between bruxism, physical abnormality, type A behavior pattern, lifestyle, perception of desirability, and controllability of stress was found by Gina, Vickymann and James \(^7\).

Apart from masticatory muscles, bruxism affects craniofacial complex, shoulder and neck. Reason being shared innervation through trigeminocervical complex, compressing upper cervical and trigeminal nerves. There is an intimate connection between jaw position, cervical muscles' activity and inclination of neck, thus influencing masseters and sternocleidomastoids activity. Also, bruxism is related to change in airway patency related to head neck postures \(^8\).

Bruxism has potential to cause tooth wear, harm structures that surround teeth, gums' recession and inflammation, periodontal disease, muscular pain, and temporomandibular joint (TMJ) dysfunction and is related to failures with restorative dental treatment, thus increasing frequency of headaches, stiffness or pathology in shoulders and neck, jaw-aches, etc. \(^7\).

Sleep-bruxism can occur alone or along with awake bruxism. Clenching/grinding is associated with microarousals, leading to pain in masticatory muscles and TMJ problems which manifests itself as clenching/rhythmic muscular contractions. Occlusal interferences is one of reasons of masticatory muscles hyperactivity, as seen in bruxism, which produces overload of masticatory muscles, sensibility, fatigue, hypertrophy, pain and joint noises due to TMJ stresses \(^2\).

Electromyography (EMG) is recording muscle’s electrical activity, thus studying motor unit activity of the muscle. Surface EMG (sEMG) uses surface electrodes for input phase in kinesiological investigation and is adequate for monitoring large superficial muscles or group of muscles \(^8\).

Musculoskeletal pain reduces maximal voluntary contraction force (MVC) as seen on sEMG. Pain adaptation model suggests that chronicity of muscular pain has potential to decrease agonist's activity and increase antagonist's activity, this mechanism occurs to prevent agonist landing up in new injury \(^9\). The chronicity of pain in bruxism is known to cause hypertrophy of masseter, tenderness and reduced MVC force of masticatory muscles. All this reduces motor activity of masticatory muscles. Also deficits are seen in voluntary activation drive due to fear of triggering noxious painful event. All this contributes further to reduced muscle firing, hence reduced MVC force \(^10\).
Management of Bruxism with occlusal splints is well-known. Occlusal splints are custom-made silicone splints that are introduced into mouth every night. Splints enable clenching/grinding to occur between teeth and splint, preventing functional contact between upper and lower teeth and thus preventing attrition and wear and tear of teeth, allowing improved performance regarding functional activities and reduction of emotional stress, commonly associated with Bruxism (4, 11, 16).

Physiotherapy management strategies include use of transcutaneous electrical nerve stimulation (TENS), microcurrent electrical nerve stimulation (MENS), Massage therapy, Relaxation techniques, Biofeedback, (3, 4, 5, 12, 13, 14, 15, 16). TENS reduces pain, induces relaxation, and improves muscle’s motor activity proving to be useful in managing symptoms of Bruxism. Maneuvers of massage therapy like petrissage, effleurage, muscle wringing and rolling of the masticatory muscles improves blood supply, pliability of muscles, induces relaxation thus helps in better functioning of masticatory symptoms along with effective management of pain, improving ROM and improving quality of life in individuals with Bruxism. Relaxation techniques focusing on local and global muscle aim at promoting high awareness of muscle tension (3,5).

Kinesio-taping (KT) brain-child of Dr. KenzoKase, which came into existence between 1973 and 1979. Traditionally, athletic taping developed since 1822. KT provides support to musculoskeletal structures without overimmobilization and preventing side-effects from it (17). KT exhibits a thickness and weight similar to skin. It’s latex-free, made up of hypoallergic cotton material, allows skin to breathe, and is made of acrylic heat-activated adhesive. KT is applied to a paper substrate with 10 % stretch and when applied to the skin for treatment, can stretch an additional 40-60 % of original length. KT lifts skin, causing convolutions, enhancing fluid exchange between tissues layers, enhances circulatory system, reduces edema, decreases pain, increases ROM, reduces fatigue, and enhances kinesthetic awareness by supporting joint, facilities and/or inhibits muscle, etc. (18,19).

KT when applied from muscle’s origin to insertion is thought to elevate fascia by pulling co-centrically, that facilitates muscular activation, hence can be applied to facilitate a weakened muscle; and in inhibitory tape, its applied from muscle’s insertion to origin, producing eccentric pull on fascia, this inhibits/decreases the muscle’s, this can be used to inhibit over-active muscle (19, 20, 21). Very less literature is available on effect of KT on individuals with bruxism. Hence this study aimed to investigate the effect of KT on pain and muscle activity in individuals with bruxism. The objectives were to find out the effect of KT on pain and muscle activity in the experimental group and compare them to the controls.

Method: study design: In this randomized controlled trial, after clearance from the Institutional Sub-ethics committee, subjects were recruited from Dr. D. Y. Patil Dental College, Pune between July-December 2018.

Participants: 30 individuals with age between 18-48 years, of both genders (13 males, 17 females) were selected after screening, as per the inclusion criteria, viz., a diagnosis of bruxism by Dentist was followed by taking the NPRS (Minimum 3). Individuals with more than 5 missing teeth, NPRS more than 7, currently using orthodontic splints, having history of systemic/joint disease, currently using analgesics, anti-inflammatory agents, muscle relaxants and currently undergoing Physiotherapy for
oro-facial problems were excluded from study. Patients were first evaluated for chief complaints, history of present illness, drug history, and then randomly divided in Experimental (Group A) and Control Groups (Group B) by chit method. Baseline parameters of NPRS and sEMG for masseter were recorded for all patients (P1).

**Intervention:** Individuals in Experimental Group received Kinesio-taping for bilateral masseter. Male patients were made to shave their face prior to tape application. Before applying tape, any history of allergy to tape was asked to all subjects. In absence of any abnormal reaction, therapeutic application was done which was supposed to be sustained for 24hrs. Two I-bands were cut. One part began from the chin while the mouth slight open and was extended to temporomandibular joint slight posteriorly. The other strip began from the corner of the lip and followed in the direction of the temporomandular joint. After the application, the tape was gently rubbed to activate the heat-dependent adhesive substance of the tape to ensure proper sticking of the tape to the skin. After application of tape, Patient were sent home with the tape. Patient were instructed to wear tape for up to 24rs. The patient were called the next day, tape removed by the therapist. NPRS and EMG were assessed 5 minutes after tape removal (after 24hrs of treatment). The patient were sent back home without tape and were called the next day. There was one drop out form experimental group on 3rd day. The subject could not show up for assessment after 48hrs due to some personal issues. For the control group NPRS and sEMG was taken for 3 consecutive days without any intervention given.

**Outcome Measures:** Two outcome measures were assessed. Numerical Pain Rating Scale (NPRS) score and sEMG were taken to assess pain and Amplitude of Masseter’s MVC respectively at Baseline (P1), 24hrs after treatment (P2) following tape removal and 48hrs post-treatment (P3) to assess for carryover effect of the tape. For sEMG, active electrode was placed 2.5 cm above mandibular angle, reference electrode was positioned over masseter’s belly parallel to muscle’s fibres with an inter electrode distance of 15 mm and ground electrode was positioned over forehead. Difference between pre-post scores of both the outcome measures for both Group were noted and statistical interference was derived.
Statistical analysis: Pre-treatment (P1) and post treatment score of NPRS and Amplitude after 24hs (P2) and after 48hrs (P3) for Group A (Experimental Group) and Group B (Control Group) was compared with repeated measure ANCOVA. Within group comparison was done by t test and between groups comparison was done by paired t test.

Results: The mean age of Group A was 23.5 years and Group B was 21.0 years. Group A (n=15) had 6 males and 9 females, whereas Group B (n=15) had 7 males and 8 females. Pre and Post treatment
results for NPRS and EMG were compared using unpaired t test which showed p<0.001 i.e. statistically significant difference, therefore Group A (Experimental Group) which received Kinesio-taping showed more improvement in Pain and Amplitude than Group B (Control Group). Pre and post treatment results for NPRS and EMG for each groups were assessed using Repeated Measure ANOVA test. The pre-pre groups for NPRS and EMG of right and left side assessed with t test showed p values were 0.26, 0.16, 0.36 and 0.21 respectively which showed that both groups are comparable. The pre-post results of CPRS of right and left side for Group A assessed using Repeated measure ANOVA showed that p value was <0.001 for both sides 24hrs as well as 48hrs post treatment when compared to baseline. The pre post results of EMG of right and left side for Group A assessed using Repeated Measure ANOVA showed that p value was <0.001 for both sides 24hrs as well as 48hrs post treatment when compared to baseline. Therefore result is statistically significant showing significant improvement in pain and masseter muscle amplitude. The results for Group B were not statistically significant showing less improvement in pain and masseter muscle amplitude. (Table No. 1).

### Table No.1

<table>
<thead>
<tr>
<th>Outcome Measure</th>
<th>Grp</th>
<th>Pre (P1)</th>
<th>Post 24hrs (P2)</th>
<th>Post 48hrs (P3)</th>
<th>MD (P1-P2)</th>
<th>MD (P1-P3)</th>
<th>MD (P2-P3)</th>
<th>f-value</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>NPRS (Right) A</td>
<td>3.80 ±0.80</td>
<td>1.13 ±0.74</td>
<td>0.87 ±0.64</td>
<td>2.67 ±0.72*</td>
<td>2.93 ±0.88*</td>
<td>0.27 ±0.80*</td>
<td>121.88</td>
<td>&lt;0.001</td>
<td></td>
</tr>
<tr>
<td>B</td>
<td>3.50 ±0.88</td>
<td>3.33 ±0.62</td>
<td>3.33 ±0.72</td>
<td>0.33 ±0.72</td>
<td>0.17 ±0.16</td>
<td>0 ±0.10</td>
<td>0.34</td>
<td></td>
<td></td>
</tr>
<tr>
<td>NPRS (Left) A</td>
<td>3.73 ±0.80</td>
<td>0.87 ±0.64</td>
<td>0.87 ±0.64</td>
<td>2.87 ±1.60*</td>
<td>2.87 ±1.25*</td>
<td>0 ±5.34*</td>
<td>83.24</td>
<td>&lt;0.001</td>
<td></td>
</tr>
<tr>
<td>B</td>
<td>3.33 ±0.62</td>
<td>3.27 ±0.90</td>
<td>3.40 ±0.99</td>
<td>0.07 ±0.60</td>
<td>0.07 ±0.70</td>
<td>0.13 ±0.64</td>
<td>0.32</td>
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<tr>
<td>AMP (Right) A</td>
<td>181.70 ±45.98</td>
<td>359.60 ±137.70</td>
<td>308.50 ±142.30</td>
<td>177.9 ±131.60*</td>
<td>126.8 ±146.90*</td>
<td>51.13 ±88.23*</td>
<td>16.17</td>
<td>&lt;0.001</td>
<td></td>
</tr>
<tr>
<td>B</td>
<td>202.10 ±71.33</td>
<td>185.10 ±56.04</td>
<td>176.50 ±61.86</td>
<td>16.93 ±73.02</td>
<td>25.53 ±57.12</td>
<td>8.60 ±55.16</td>
<td>1.31</td>
<td></td>
<td></td>
</tr>
<tr>
<td>AMP (Left) A</td>
<td>183.00 ±48.72</td>
<td>424.60 ±179.10</td>
<td>395.30 ±167.30</td>
<td>241.60 ±158.80*</td>
<td>212.3 ±143.50*</td>
<td>29.279±9.62*</td>
<td>28.48</td>
<td>&lt;0.001</td>
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<tr>
<td>B</td>
<td>208.20 ±57.29</td>
<td>250.90 ±104.70</td>
<td>232.30 ±63.02</td>
<td>42.76 ±106</td>
<td>24.13 ±56.09</td>
<td>18.53 ±97.52</td>
<td>1.73</td>
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<td></td>
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</table>

*Results were Statistically Significant

Abbreviations: Grp- Group; M D- Mean Difference; AMP-Amplitude.

**Discussion:** Results in our showed significant improvement in Pain after 24hrs as well as when assessed at 48hr interval. Pain reducing effect of kinesiotape can be credited to its property of elevation of fascia thus expansion of space below skin and soft tissues, hence improving space...
available for movement, thus facilitating blood circulation, lymph fluid movement, and increase healing rate of tissue (18, 19, 23). This is in accord with previous study done by Danuta et al. in 2018 which assessed short-term effects of Kinesiotaping and trigger point release (ischaemic compression) in Masticatory muscles' functional disorder. Both the technique showed significant reduction in pain (assessed by NPRS), superior effect of kinesiotaping was mainly based on normalizing muscle tension, supporting work of joints, improving function of weakened muscles, and increasing microcirculation at application site (24).

Ilke et al. in 2016 assessed effectiveness of Kinesiotaping of masseter in individuals with TMD and found that use of kinesiotape had additional benefits in reducing masseter’s pain. This pain reduction can be accredited to its effects of creating folds that lifts skin, directs fluids flowing from high to low pressure areas beneath skin, blood and lymph flow begin to increase; this reduces inflammation, flushes out metabolites leading to decrease pain by reducing pressure on receptors of pain (22).

Rajpurohit et al. in 2010 compared effect of TENS with MENS on masticatory muscles’s pain in bruxing population. Pain of masseter, as measured by VAS and digital pressure algometer, has statistically reduced with both modalities. Both modalities were effective in reducing pain, and pain reduction can be accredited to Pain-gate theory modulating pain at spinal level (23). Similar effect of Kinesiotape have been documented in stimulating large diameter fibers and inhibiting pain at spinal level (18, 19). Positive effects of kinesiotaping on pain has been reported by studies carried out in other muscles and other conditions (24, 25, 26).

However, effectiveness of Kinesiotaping on pain remains contradictory. In a study by Marco et al. use of kinesiotape for individuals with chronic lower back ache did not provide any additional benefits in reducing pain, manual therapy and exercise alone helped in reducing pain to a statistically significant level. This study does not recommend use of tape (11). Similarly study done by Yildiz et al in 2018 to find out whether expectations of patients’ on kinesiotape have effect on outcomes in individuals rotator cuff tear found that when positive expectations about tape are set verbally, its affectivity in reducing pain may increase, thus inconclusive whether pain reduction is due to positive effects of tape or mere a placebo (27).

Present study also showed significant improvement in Amplitude of Masseter Muscle in Group A. Study done by Danuta et al. in 2018 showed superior effects on Pain reduction with use of kinesiotape and superior effect of kinesiotaping was mainly based on normalizing muscle tension, supporting work of joints, improving function of weakened muscles, and increasing microcirculation at application site, all of this cumulating to help in increasing maximum voluntary contraction and thus improve amplitude as seen in our study (28).

Literature reports that during chronic muscular pain, muscles’ contractibility reduces because of reduction of agonistic activity and increase antagonist activity. Therefore anything reducing pain will help in improving contractibility and muscle function. Also, it’s a known fact that pain inhibits voluntary muscle function (29).
In a study done by Delaine et al. in 2004, effectiveness of single application of TENS on masticatory muscles was assessed in TMD. EMG of the masticatory muscles was assessed as MVC before and after treatment. Pain (VAS) showed statistically significant difference and MVC showed decrease in anterior temporalis’ amplitude and increase in Masseters’ amplitude. TENS is an effective tool for pain relief because of its property of mechanoreceptors’ stimulation. Similarly, Kinesiotape can be thought as an effective tool in inducing relaxation by virtue of its known property of mechanoreceptors stimulation, help in reduce pain by improving blood flow and thus improve muscle function. Similar positive effects of kinesiotaping on improving muscle strength has been reported by studies carried out in other muscles and other conditions.

However, literature remains inconclusive about use of kinesiotape in facilitation/ inhibition of muscles. Csapo et al. conducted a meta-analysis and concluded that Kinesiotape usage to increase muscle strength has negligible to no effect in different muscle groups. Similarly, study done by Yeung et al. in 2014 concluded that there were no changes in regards of increasing muscle peak torque or total work after an isometric fatigue protocol after application of Kinesiotape on Vastusmedialis.

Our study also obtained a feedback about the subjects’ experience with kinesiotape. All subjects experienced less pain following application of kinesiotape, all subjects felt well with tape, it stayed well for 24hrs without any adverse reaction, and everyone wished to apply it again. 86.67 % individuals felt that episode of clenching/bruxing reduced with application of tape and 60% could perceive the tape as part of the skin while wearing it. 13.33 % individuals were not comfortable with application of tape, especially due to cosmetic reasons. The limitations of our study was small sample size, all types of bruxers were considered, short term effects of tape were only assessed. Long term effects of tape can be assessed in managing Bruxism in future.

Conclusion: The present study confirmed that Kinesiotaping significantly improved Pain and Masseter muscle activity in individuals with Bruxism. This study also found significant carryover effect on pain and muscle activity after 24hrs of tape removal. Kinesiotaping can be used along with other therapy to manage symptoms of Bruxism.

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References:


3) Alice Ramos de Freitas, Marcelo Magalhães Dias, Hilmo Barreto Leite Falcão Filho, Andréa Araújo de Vasconcellos; Sleep Bruxism in Children: Prevalence and Multidisciplinary Therapy; OHDM; December, 2014 Vol. 13(4): 897-901

4) C. Santos Miotto de Amorim, G. Fioranelli Vieira, E. Ferreira Osses Firsoff, J. Rosana Costa, A. Pasqual Marques; Effectiveness of two physical therapy interventions in masticatory muscular pain, mandibular range of motion and stress in individuals with bruxism; WCPT Congress 2015 / Physiotherapy 2015; Volume 101, Supplement 1 eS1238–eS1642.


8) Susan B. Osullivanian, Thomas J. Schmitz; Physical Rehabilitation, Fifth Edittion, 273-282


12) Bharat Rajpurohit, Subhash M Khatril, Deepa Metgud2, Anjana Bagewadi; Effectiveness of transcutaneous electrical nerve stimulation and microcurrent electrical nerve stimulation in bruxism associated with masticatory muscle pain - A comparative study, Indian J Dent Res, 21(1), 2010


15) Lu-Fei Wang; Biofeedback treatment for sleep bruxism: a systematic review; Sleep Breath (2014) 18:235–242
17) Wei-Ting Wu, Chang-Zern Hong, Li-Wei Chou; The Kinesio Taping Method for Myofascial Pain Control: Hindawi Publishing Corporation, Evidence-Based Complementary and Alternative Medicine; 2015; Article ID 950519
19) Rachael M. German; Inhibitory kinesio tape application to the hamstring muscle group: an investigation of active range of motion and perceived tightness over time; Education, health, and human services, May 2013: 76pp: rave.ohiolink.edu: www.etd.ohiolink.edu
20) Serrao et al., Effect of 3 Different Applications of Kinesio Taping Denko® on Electromyographic Activity: Inhibition or Facilitation of the Quadriceps of Males during Squat Exercise, Journal of Sports Science and Medicine (2016) 15, 403-409
27) Yildiz Analay Akbaba, Ebru Kaya Mutlu, Suleyman Altun, Derya Celik. Does the patients' expectations on kinesiotape affect the outcomes of patients with a rotator cuff tear? A randomized controlled clinical trial. Clinical Rehabilitation, 2018.00(0)
28) Danuta Lietz-Kijak, Łukasz Kopacz, Roman Ardan, Marta Grzegocka, and Edward Kijak. Assessment of the Short-Term Effectiveness of Kinesiotaping and Trigger Points Release Used
in Functional Disorders of the Masticatory Muscles. Pain Research and Management


34) Abdullah A. Abubaker, Qassim I Muaidi. The Effect of the Inhibition Technique of the Kinesio Taping on the Triceps Surae Muscle after an Isokinetic Fatigue Protocol. MOJ OrthopRheumatol 2018, 10(1): 00384


Corresponding Author:
Dr. Nidhi Keniya, MPT in Orthopaedics
Dr. D.Y. Patil College of Physiotherapy, Pimpri, Pune-411018
Email address: nidhipkeniya@gmail.com