Efficacy of Kinesio Taping in Post Operative Sequalae After Surgical Removal of Mandibular Third Molars: a Split Mouth Randomized Control Study

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Research Article

Keywords: Kinesio taping, Kinesiologic tape, third molar, transalveolar extraction

Posted Date: May 24th, 2023

DOI: https://doi.org/10.21203/rs.3.rs-2817358/v1

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Abstract

Background - Surgical removal of impacted lower third molars produces a significant degree of trauma to the soft tissue and bony structures of the oral cavity, which can initiate considerable inflammatory reaction. Consequently, patient experiences pain, swelling, hemorrhage, nerve paraesthesia, limited mouth opening etc. The kinesiologic tape (KT) can help with blood and lymphatic circulation and has shown acceptable outcomes in reducing pain and in managing post-operative muscle spasm.

Methodology – The study was aimed to compare the effects of kinesiologic tape on post operative pain, swelling and trismus following surgical removal of mandibular third molar when compared to control group. 15 patients with bilaterally impacted mandibular third molar were included in this split mouth study. One side was randomly assigned as Group A where patient's face was subjected to Kinesio tape application post extraction. The other was Group B where Kinesio tape was not applied. After extraction each patient was evaluated in terms of post op pain, swelling and trismus in post-op day 1, 2 and 7th.

Results - Pain was found to be significantly less (p =0.042) in group A when compared to group B on the first day. The mean pain was 5.07 in KT group and 6.20 in No KT group on day 2nd. Post OP Swelling was statistically significantly less (p <0.01) in Group A on 2nd & 3rd day. The postoperative mouth opening was more from the 2nd day in group A with mean of 26.07 mm and 20.33 mm in group B (p<0.01).

Conclusion- The kinesiologic taping originates from sports medicine, but can also used therapeutically for reducing post operative sequelae as demonstrated in our study. Kinesiologic tape (KT) enables patients to have a comfortable time post-operatively and helps to regain better quality of life.

Trial Registration – Registered in Clinical Trial Registry - India
Registration number - CTRI/2021/05/033359, registration date – 04/05/2021

INTRODUCTION

Third molar transalveolar extractions are one of the most common procedures routinely performed in oral surgery. Subsequent to transalveolar extraction of impacted lower third molars, there is significant level of trauma to the soft and hard tissue in the oral cavity. Consequently, patients may experience numerous problems such as facial swelling, pain, hemorrhage, dry socket, nerve paraesthesia, and limited mouth opening(1,2).

Amongst these postoperative outcomes of third molar surgeries- pain, difficulty in mouth opening and facial oedema are most common. A broad research has been done for third molar surgeries in terms of post operative management, especially pertaining to pain, facial oedema and difficulty in mouth opening.(1,3) After the cessation of anaesthetic effect, the pain reaches to its maximal level within 3-5 hours, stays for following 2-3 days, and then progressively fades by day 7. Whereas the swelling reaches its maximum level during initial 12-48 hours and fades within 5-7 days (4,5). Nonetheless, trismus purses until the pain and swelling subsides.

KT is an elastic therapeutic tape created by Dr. Kase in 1970s. KT was developed as an adjuvant treatment modality in sports medicine and it is primarily utilized to support injured soft tissues (muscles and joints). KT is believed to regulate blood and lymph flow along with removal of lymphatic fluid or haemorrhage congestions by
elevating the skin and enabling fluids to shift from areas of higher pressure to lower pressure. Moreover, KT influences muscular mechanoreceptors, which reduces pain and also facial oedema.[6,7]

In recent years, several researchers have successfully used KT following surgery for temporomandibular problems, orthognathic therapy, mandibular fractures, and midface fractures (8,9,10). Although theory predicts that clinical advantages should follow, data to support this is scant.

The aim of this study was to compare the effect of extra oral application of kinesiologic tape on post operative sequelae following surgical removal of mandibular third molar.

Objectives:

1) To assess post-operative pain, swelling and trismus following third molar surgery after applying KT.

2) To assess post-operative pain, swelling and trismus following third molar surgery without applying KT.

3) Comparison of post operative pain, swelling & trismus following third molar surgery between the two groups.

METHODOLOGY

STUDY DESIGN:

The study was a prospective randomized control study. It was a split-mouth clinical study, designed to assess the efficacy of KT on post-operative manifestations after transalveolar extraction of mandibular third molar. The study was non blinded. Fifteen patients were included in the study for extraction of bilaterally impacted mandibular third molars with a similar difficulty score of 4-5 according to Pederson’s difficulty index. The oral cavity was divided into two groups. Group A was the ‘Test group’ (KT group) in which one side of patient’s face was subjected to application of Kinesiologic tape. Group B was the Control group (No KT) which was the other side of patient’s face, on which KT was not applied.

SAMPLE SETTING

The patients were selected from the Out-Patient Department (OPD) of the “Department of Oral and Maxillofacial Surgery, Sharad Pawar Dental College, Sawangi, Wardha’.

STUDY DURATION: November 2021- November 2022

Methods: Assigning interventions (for controlled trials):

- Allocation: Study population was divided randomly into 2 equal groups - Test group (KT) & control group (No KT) using table of random numbers.
- Blinding: Non blinding study
- Implementation: Independent observer
- Randomization: Simple using odd even method

Data collection, management and methods for analysis:
Data collection methods: Patients visiting OPD of “Oral and Maxillofacial Surgery department, Sharad Pawar Dental College”.

Ethics and dissemination:

This study is approved from institutional ethical committee “Sharad Pawar Dental College” “[Ref. No-DMIMS(DU)/IEC/2020-21/9418].”

Declaration: This research was done after approval by the guidelines agreed by IEC of DMIMS DU and was conducted under the Helsinki declaration 2013.

**SAMPLE SIZE:** 15 in both the groups

**SAMPLE SIZE CALCULATION:**

The sample size was calculated using the result of previous study of Gözlüklü Özgür et al (2019)[4]. The calculation of the sample size required for this study used the following formula at 95 percent confidence interval and 80 percent power of the study.
The testing of the Hypothesis for two means (equal variances), Standard deviation in group 1, \(SD_1= 9.08\).
Standard deviation in group 2, \(SD_2=6.88\), \(SP= SD_1 + SD_2/2\);
Mean difference between 1st and 2nd sample = 8.22, Effect size=1, Power (%)=80, Sided-2, where \(Z_{1-\alpha/2}\) is critical value of the normal distribution at \(1-\alpha/2\) (confidence level of 95%, the critical value is 1.96 and \(\alpha = 0.05\), the critical value is \(Z_{1-\beta}\) of the normal distribution at \(1-\beta\) (power of 80%, \(\beta = 0.2\) and the critical value is 0.84), and \(\Delta\) is the mean difference in groups.

\[
n_1 = \frac{\left(\sigma_1^2 + \sigma_2^2/k\right)(z_{1-\alpha/2} + z_{1-\beta})^2}{\Delta^2}
\]

\[
n_2 = \frac{\left(k^* \sigma_1^2 + \sigma_2^2\right)(z_{1-\alpha/2} + z_{1-\beta})^2}{\Delta^2}
\]

The formula has the following notation:

- group 1 sample size = \(n_1\)
- group 2 sample size = \(n_2\)
- standard deviation for group 1 = \(\sigma_1\)
- standard deviation for group 2 = \(\sigma_2\)
- difference in mean of group = \(\Delta\)
- \(K\) (ratio) = \(n_2/n_1\)
- \(z_{(1-\alpha/2)}\) = Z value two sided (eg. \(Z = 1.96\) for confidence interval 95%)
- \(z_{(1-\beta)}\) = power

The testing of the Hypothesis for two means (equal variances), Standard deviation in group 1, SD1= 9.08. Standard deviation in group 2, SD2=6.88, \(SP= SD_1 + SD_2/2\); Mean difference between 1st and 2nd sample = 8.22, Effect size=1, Power (%)=80, Sided-2, where \(Z_{1-\alpha/2}\) is critical value of the normal distribution at \(1-\alpha/2\) (confidence level of 95%, the critical value is 1.96 and \(\alpha = 0.05\), the critical value is \(Z_{1-\beta}\) of the normal distribution at \(1-\beta\) (power of 80%, \(\beta = 0.2\) and the critical value is 0.84), and \(\Delta\) is the mean difference in groups.

\(n = 15\)

Therefore, the calculated sample size for this study was 15 per group keeping in mind the distribution was made equally, 15 subjects allotted in study group (with KT) and control group (No KT).

**CRITERION For INCLUSION:**

1. Age of 18 years and above.
2. Bilaterally impacted mandibular third molar in a near similar difficulty index.
3. A medical history devoid of any systemic conditions.
4. A medical history able to introduce variables into the experiment and is devoid of any pharmacological therapy.

**CRITERION FOR EXCLUSION:**

1. Patients with dissimilar type of 3rd molar impactions.
2. Patients not willing to participate in the study.
3. Patients presenting with uncontrolled systemic diseases.

**Surgical procedure:**

The surgical procedure involved two extractions for each patient, separated by a two-week interval. The procedure was performed by a single operator under aseptic conditions following standard surgical protocols. Local anesthesia was administered using 2% lignocaine with 1:200,000 epinephrine injected for appropriate nerve blocks. Incision was made using no. 15 surgical blade and a full thickness mucoperiosteal flap was elevated. Osteotomy was performed via round & fissured burs with irrigation of sterile saline, and the tooth was extracted using dental forceps or an elevator. The socket was curetted, and the uneven bone borders of the alveolus were smoothed. Finally, the flap was repositioned and sutured using 3-0 silk.

**Application of Kinesio Tape:**

Following extraction, Kinesio Tape (KT) was applied to test group 1. The tape used was Kinesio Tex Gold Finger Print. It was cut into five equal strips, each 1 cm in width and 18 cm in length, as shown in Figure 1. The strips were placed between the clavicle and the tragus-commissure line. The patients were assessed for pain, swelling, and trismus. Pain was evaluated subjectively on postoperative days 1 (T1), 2 (T2), 3 (T3), and 7 (T7) using a Visual Analog Scale (VAS), where 0 indicating no pain & 10 indicating the worst. Facial swelling was measured using a measuring tape on preoperative and postoperative days 1, 2, 3, and 7. The measurements were taken in the three lines as shown in Figure 2. The measurement lines were inspired from a study by Ana Carolina Heras et al. (2019)(1). Line 1- from the most lateral point of the lips to the most posterior point of the tragus, Line 2- from the soft tissue pogonion point to the most posterior point of the tragus, Line 3- from angle of the mandible to the ala of the nose. Maximal mouth opening that is maximum inter-incisal distance (IID) was measured by using vernier callipers, post-operatively on 1st, 2nd, 3rd and 7th days.

**Statistical analysis:** Under the guidance of the statistician, data was collected and tabulated in an excel sheet. The standard deviations and means of the measurements for each group were gathered for statistical analysis (SPSS 22.00 for windows; SPSS inc, Chicago, USA). The data was statistically analyzed for each assessment, using one way ANOVA. The use of student t-test along with chi square test determined the difference between two groups and the level of significance was kept at p < 0.05.

**Results**
A total of 15 patients were evaluated in each category of our study. The gender and age of the patient shows clinically insignificant bias as evaluated statistically in our study. There were 6 male patients and 9 female patients chosen for bilateral extraction of mandibular third molar. The mean age of the patients was noted to be 29.53 years.

The evaluation of the patient in whom third molar surgery was carried out in terms of pain, swelling and interincisal mouth opening in both taping and control group. The pain was evaluated by VAS score. The mean of VAS score was noted to be 7.13 and 7.73 respectively in KT group and No KT group on first post- operative day. Pain was found to be significantly less (p =0.042) in KT group when compared to the NO KT group on the first day. The mean pain was 5.07 in KT group and 6.20 in NO KT group on day 2nd which implies patients with kinesio taping had more relief on the 2nd day when compared to no application of kinesio tape (Figure 3). Maximum pain is noted in the patients on the first and second day post-operatively which was significantly reduced in KT group(Table 1) shows it as an advantage of taping procedure. Overall pain was less in KT group when compared to the No KT group which was statistically significant(p<0.01).

### Table 1: Comparison of pain at different intervals among the study groups

<table>
<thead>
<tr>
<th>Pain</th>
<th>KT</th>
<th>No KT</th>
<th>t test</th>
<th>p value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean</td>
<td>SD</td>
<td>Mean</td>
<td>SD</td>
<td></td>
</tr>
<tr>
<td>Day 1</td>
<td>7.13</td>
<td>0.74</td>
<td>7.73</td>
<td>0.79</td>
</tr>
<tr>
<td>Day 2</td>
<td>5.07</td>
<td>0.88</td>
<td>6.20</td>
<td>0.86</td>
</tr>
<tr>
<td>Day 3</td>
<td>3.87</td>
<td>0.74</td>
<td>4.07</td>
<td>0.96</td>
</tr>
<tr>
<td>Day 7</td>
<td>2.27</td>
<td>0.46</td>
<td>2.40</td>
<td>0.74</td>
</tr>
</tbody>
</table>

Anova Test 13.57 13.09

p value <0.01** <0.01**

*: statistically significant, **: highly significant

### Table 2: Comparison of swelling at different intervals among the study groups

<table>
<thead>
<tr>
<th>Swelling (mm)</th>
<th>KT</th>
<th>No KT</th>
<th>t test</th>
<th>p value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean</td>
<td>SD</td>
<td>Mean</td>
<td>SD</td>
<td></td>
</tr>
<tr>
<td>Day 1</td>
<td>153.89</td>
<td>6.87</td>
<td>152.27</td>
<td>6.04</td>
</tr>
<tr>
<td>Day 2</td>
<td>148.76</td>
<td>6.26</td>
<td>156.60</td>
<td>6.03</td>
</tr>
<tr>
<td>Day 3</td>
<td>145.33</td>
<td>6.13</td>
<td>148.89</td>
<td>6.14</td>
</tr>
<tr>
<td>Day 7</td>
<td>143.56</td>
<td>5.90</td>
<td>143.82</td>
<td>5.89</td>
</tr>
</tbody>
</table>

Anova Test 6.29 7.82

p value 0.041* 0.009*
The swelling in patients without taping was noted to increase till the 2\textsuperscript{nd} day (mean 156.60 mm) which is 9.23\% increased signifying the inflammatory response of the patient when compared with pre-operative measurements. In KT group, the swelling increased to 7.31\% (mean percentage) on 1\textsuperscript{st} day, 3.75\% on day 2\textsuperscript{nd} and 1.36\% on day 3\textsuperscript{rd} (Figure 4). When KT group was compared to the No KT group in terms of extent of swelling, it was noted that the swelling was less with KT on 2\textsuperscript{nd} & 3\textsuperscript{rd} day which was highly significant statistically (p <0.01) as shown in the Table 2. This signifies resolving of inflammatory response in KT and hence more comfort for the patient postoperatively. Overall swelling resolves by day 7\textsuperscript{th} in both the groups.

The postoperative mouth opening was more from the 2\textsuperscript{nd} day in KT group with mean of 26.07 mm and 20.33 mm in No KT group (p<0.01). Trismus when noted on the 3\textsuperscript{th} day was also reduced with mean interincisal mouth opening of 29.13 mm in KT group and 23.20 mm when compared to the No KT group(Table 3). The recovery from trismus is directly related with reduction of pain and swelling from post-operative day 2\textsuperscript{nd} which is seen in patients and also verified by our results.

| Table 3: Comparison of interincisal mouth opening among the study groups |
|---------------------------|----------------|----------------|-----------|-----------|-----------|-----------|
| Interincisal Mouth Opening (mm) | KT            | NO KT          | t test    | p value   |           |           |
| Mean         | SD         | Mean         | SD         |           |           |           |
| Pre-operative | 34.27 1.94 | 34.53 1.64   | 0.17       | 0.69      |           |           |
| Day 1        | 23.87 2.42 | 22.93 1.94   | 1.36       | 0.25      |           |           |
| Day 2        | 26.07 1.98 | 20.33 2.55   | 47.19      | <0.01**   |           |           |
| Day 3        | 29.13 1.46 | 23.20 3.26   | 41.50      | <0.01**   |           |           |
| Day 7        | 33.67 1.88 | 33.20 1.89   | 0.46       | 0.50      |           |           |
| Anova Test   | 8.91       | 9.27         |           |           |           |           |
| p value      | 0.008*     | 0.006*       |           |           |           |           |

*: statistically significant, **: highly significant

**Discussion**

Kinesio Taping is a treatment modality based on body’s own natural healing mechanism. This technique displays its adequacy through the neurological and circulatory function of the body, essentially coming from the study of Kinesiology, perceiving the significance of body and muscle actions in recovery and everyday wear and tear. It is a newer approach to treat nerves, muscles, and organs, having found its way in orthopedic treatment. (11,12)

Surgical removal of 3\textsuperscript{rd} molars inflicts a certain degree of trauma to both hard and soft tissues of oral cavity. This initiates an inflammatory reaction involving the damaged tissues. (13,14) Oral muscle function is not exclusively limited to the tissue movements, yet additionally controls the course of venous and lymph streams,
internal temperature, and so forth. Hence, with muscle injury during 3rd molar surgery, various clinical manifestations are observed.(4,15) Kinesio taping aims to provide a free range of motion to the muscles in order to ensure adequate healing biomechanically rather than restricting and immobilizing the affected muscles and joints like conventional athletic tapes.(16,17)

The purpose behind this study was to uncover whether theoretically based findings regarding KT can be clinically implemented as well. One of the primary parameters, pain was reported to be significantly less in KT group when compared to the No KT group since the first day. The mean pain was 5.07 in taping group and 6.2 in control group on day 2 which implies KT group had lot more relief on the 2nd day when compared to NO KT. The results of this study suggest that kinesio taping is a superior modality to reduce the post operative pain in patient who has undergone third molar surgery.

A similar study was conducted by Yurttutan et. al. (2020)(18) where 30 patients were randomly divided into 2 groups, half with KT application and half without it. Tape was applied directly after impacted third molar surgery and maintained for postoperative 7 days. Analgesic usage for pain were recorded on post-op 1st, 2nd, 3rd & 7th days. There was significantly lower use of analgesics in the group with KT application.

When Kinesio taping group was compared to the non-taping group to assess the extent of swelling, it was noted in our study that the swelling was less in taping group which was highly significant statistically when compared on the 2nd day and 3rd day. The results of our study are in concurrence with the study performed by Ana Carolina Heras et al. (2019)(1) in which they concluded that application of KT tape post third molar extraction reduces edema and pain intensity. In their study thirteen individuals were subjected to extraction of third molar on both sides showed positive results on the KT side 5 days after surgery.

As has been proven in the past, post operative mouth opening is directly related to associated pain and swelling. This was also confirmed in our study statistically. The recovery when observed on the seventh day was also significantly higher when compared to the No KT group. The study by Yushan Wang et. al. (2021)(11) was aimed at evaluating whether Kinesio taping (KT) can improve patient discomfort after mandibular third molar surgery. The results showed postoperative application of KT improved restricted mouth opening in the early and late postoperative periods.

The therapeutic application of KT has recently emerged in maxillofacial surgery. Furthermore, use of KT is not limited to third molar surgery but KT has also in the treatment of facial trauma and those requiring orthognathic surgery as well as temporomandibular disorders.(8) In a previous study, a randomized clinical trial by Ristow et al. (2013)(10) where application of KT following surgical treatment of fractures of mandible and concluded that it had a considerable effect on tissue response and swelling thereby reduced the prevalence of swelling during the first two post-operative day by more than 60%.

In a recent study by Kim MG, Kim MY (2020)(19), KT application was done for management of post-operative complications after cyst enucleation. KT was applied additionally to basic postoperative care after surgery & a control (No KT) group in which patients without KT application had only basic postoperative care showed that KT had effectively managed facial swelling.
The Kinesiologic tape is designed to have a longitudinal stretch that is comparable to human skin, stretching 55-60% of its resting length. Its thickness is similar to the epidermis of the skin to limit the patient's perception of weight and avoid sensory stimuli when applied properly. Patients do not perceive any sense of tape applied to the skin after 10 minutes. (6,20) In this study, the Fan strip application method for lymphatic correction was used, with none to very light tension added to the strip tails. The tape is applied to a stretched site, creating convolutions as the skin is lifted. This opens initial lymphatic channels and reduces pressure, while during active motion the tape also generates a massaging action, improving the proficiency of the deep lymphatics by allowing relaxation and contraction of muscles to its maximum. (6,7) In our study, we found that KT was effective in reducing post-operative pain, edema and trismus, particularly on second and third post-operative days. All of these complications can be minimalized with clinical therapeutic application of Kinesio tape on impacted third molar surgeries. The parameters included in the study, Pain, swelling and trismus are not independent variables. Hence, it cannot be directly related to application of KT and this was one of the major drawbacks of this study. Besides, KT is an extraoral tape so blinding the KT group of patients was not possible, which may also have added to the bias. Further studies are needed in well-defined patient populations.

CONCLUSION

As kinesiologic taping originates from sports medicine, but can also used therapeutically for reducing post operative sequelae as demonstrated in our study. Due to lack of evidence-based research at present, KT application for treatment of post-operative edema in head and neck surgeries is being explored. Whereas comparing KT application with the use of analgesics is controversial. However, this may decrease the need for analgesics and NSAIDS, thus reduced side effects related to these drugs will be anticipated.

Declarations

- Ethics approval and consent to participate - The study was conducted in accordance with the Helsinki declaration and its later amendments or comparable ethical standards and after approval by the institutional ethical guidelines prescribed by Central Ethics Committee on Human Research (C.E.C.H.R) of Datta Meghe Institute of Higher Education and Research. All patients were included in the study after taking their signature on written informed consent form.
- Consent for publication – Not applicable.
- Availability of data and materials – The datasets generated and/or analysed during the current study are available in the [Zenodo] repository, [https://doi.org/10.5281/zenodo.7827614]
- Competing interests - The authors declare that they have no competing interests
- Funding - None
- Authors' contributions – SP was the major operator and recorded all data. RK designed the study and was major contributor in writing the manuscript. NB was the data analyst and supervised the study, also contributed in writing the manuscript. All authors read and approved the final manuscript.
- Acknowledgements – Not applicable

References


Figures
Figure 1

Preparation of Kinesio Taping.

A. The tape was cut into 5 equal strips, 1 cm in width and 18 cms in length
B. Fan strips of Kinesio Tape.
Figure 2

Three Reference lines for measurement of swelling
Figure 3

Comparison of pain at different intervals among the study groups

Figure 3

Comparison of pain at different intervals among the study groups
Figure 4

Comparison of swelling at different intervals among the study groups