Clin Oral Invest (2014) 18:1205–1212
DOI 10.1007/s00784-013-1067-3

ORIGINAL ARTICLE

Therapeutic elastic tape reduces morbidity after wisdom teeth removal—a clinical trial

Oliver Ristow · Bettina Hohlweg-Majert · Stephen R. Stürzenbaum · Victoria Kehl · Steffen Koerdt · Lilian Hahnefeld · Christoph Pautke

Received: 20 April 2013 / Accepted: 18 July 2013 / Published online: 21 August 2013

Abstract
Objectives Although the extraction of an impacted third molar (3M) is a routine procedure, postoperative morbidities typically include swelling, pain, and trismus. The aim of the present study was to investigate whether the application of kinesiologic tape can improve the postoperative morbidities associated with 3M surgery, thereby improving the postoperative well-being of patients.
Materials and methods Forty patients assigned for prospective 3M removal were randomized into two treatment groups (with/without kinesiologic tape). Facial swelling was quantified using a five-line measurement at six specific time points. Pain scores were assessed using a visual analog scale, and mouth opening range was assessed by means of standard calipers. In addition, all patients were asked to evaluate overall satisfaction and swelling (both groups) and the effect of the tape on movement and comfort (taped group only).
Results The postoperational application of kinesiologic tape reduced significantly all investigated parameters: swelling, pain, and trismus. Furthermore, patients with kinesiologic tape reported a significantly lower morbidity rate.
Conclusion The application of kinesiologic tape following a 3M surgery is a simple and economical, yet medically relevant approach.
Clinical relevance Kinesiologic tape offers patients a less traumatic postoperational experience and therefore holds promise to enhance the quality of life of a large cohort of the population.

Keywords Kinesio tape · Third molar · Swelling · Pain · Trismus · Morbidity, extraction

O. Ristow (✉) · B. Hohlweg-Majert · L. Hahnefeld · C. Pautke
Medizin und Aesthetik, Clinic for Oral and Maxillofacial and Plastic Surgery, Lenbachplatz 2a, 80333 Munich, Germany
e-mail: ristow@aesthetik-muenchen.de

O. Ristow · S. Koerdt · L. Hahnefeld
University of Munich, Goethestr. 70, 80336 Munich, Germany

B. Hohlweg-Majert
Department of Oral and Maxillofacial Surgery, Technical University of Munich, Ismaninger Str. 22, 81675 Munich, Germany

S. R. Stürzenbaum
School of Biomedical Sciences, King's College London, London SE1 9NH, UK

V. Kehl
Institute of Medical Statistics and Epidemiology, Technical University of Munich, Ismaninger Straße 22, 81675 Munich, Germany

C. Pautke
Department of Oral and Maxillofacial Surgery, University of Munich, Lindwurmstr. 2a, 80336 Munich, Germany

Introduction

The removal of third molars (3M) is one of the most frequent operations, and in the USA alone, over 10 million operations are performed annually affecting some 5 million patients. This surgical intervention results in an annual cost exceeding $3 billion and with over 11 million patient days of postoperative discomfort and disability; the true economic cost is by no means negligible [1–3].

Closure techniques [4, 5], drains [6], drugs [7], laser application [8], or physical therapy [9, 10] have all been applied in an attempt to reduce the postoperative morbidity of 3M surgery; however, no modality was sufficiently reliable to significantly prevent the occurrence of complications. Therefore, new approaches are required that are able to effectively manage pain, swelling, and trismus.

Kinesiologic tape (KT), an elastic therapeutic tape, was developed by Dr. Kase in the 1970s [11]. With its origins in sports science, KT techniques have been applied to support

injured muscles and joints, helping to relieve pain [12]. KT is thought to improve the blood and lymph flow, remove congestions of lymphatic fluid or hemorrhages, and thus, its use has gained popularity in the management of lymphedema [13, 14]. Being similar in weight to the epidermis, KT appears to exert its effect on lymphatic drainage by lifting the skin thereby guiding fluids to move from higher pressure to lower pressure areas [13–15]. The profile and brand recognition of KT increased after the tape was donated to 58 countries for use during the 2008 Olympic Games and therefore used by several high-profile athletes [16]. However, despite the vast clinical experience and clever commercial exploitation of KT, evidence-based scientific publications are surprisingly sparse [17, 18]. It is conceivable that the application of KT may alleviate the postoperative morbidity of 3M extraction by accelerating drainage of tissue reaction or hemorrhages, a hypothesis this study sets out to investigate.

Material and methods

Study sample

This study has been performed in accordance with the ethical standards laid down in the 1964 Declaration of Helsinki and its later amendments. After obtaining the approval of the institutional ethics committee, informed consent was obtained from all patients. Forty patients were consecutively recruited, over a 12-month period, to participate in our prospective, monocentric, parallel-group, open-label, randomized clinical trial and randomized into two study groups: (1) KT group and (2) no-KT group. The inclusion criterion was the presence of bilateral impacted upper and lower third molars (Pell and Gregory classification: mandible/maxilla class B and C [19]) justifying the extraction in general anesthesia and hospitalization. Exclusion criteria were patients younger than 18, pregnant or lactating women, sensitivities to tape, unwillingness to shave facial hair, known allergies to medication used in the study, and inflammatory reactions after surgery.

Surgery

All operation procedures were performed by two board-certified specialist oral and maxillofacial surgeons (BHM, CP) in general anesthesia. Surgery was performed under sterile conditions following a standard operating protocol [20]. The osteotomy (and crown sectioning if necessary) was performed using sterile low-speed hand pieces (Kavo®, Biberach, Germany) and sterile saline irrigation. The teeth were removed using an elevator or dental forceps. Thereafter, curettage of the socket was carried out and irregular bone boarders of the alveolus were evened. Wound closure was performed using a buccal mucoperiosteal flap and resorbable sutures (3–0, Viryl; ethicon®). Perioperatively, a single shot of antibiotics (ampicillin/sulbactam kabi, 2,000 mg/1,000 mg) was applied. All patients were treated as inpatients and received the routine postoperative instructions. Both study groups received ice packs in 30-min intervals for 6 h after surgery and analgesic and anti-inflammatory medication (diclofenac, 50 mg) every 8 h for 3 days.

Taping

All taping procedures were performed by the same investigator (OR), a certified K-Taping therapist. The tape was applied immediately after the surgical 3M removal and prior to patients waking up from anesthesia. The skin was cleaned, shaved if necessary, and any residual moisture and oil removed. All tape applications were performed using skin colored K-Active Tape Classic®, 50 mm×5 m (K-Active Europe GmbH, Wiesthal, Germany). Tape length was customized for each patient, defined by the distance (in the stretched position) between the clavicle and the position of most severe swelling. The base of three strips (of equal length ±1.5 cm) was placed just above the supraclavicular nodes (the target area for drainage). Placement of the lymphatic strips was directed by the location of the lymphatic duct crossing the cervical, sub mental, mandibular, submandibular, preauricular, and parotid nodes to the area of maximum swelling (Fig. 1a). The tape was gently rubbed to activate the medical grade acrylic adhesive and remained for at least 5 days. During therapy, a change of tape was not necessary.

Data collection methods

All measurements, performed by the same investigators (OR, LH), were conducted at six specific time points (T): preoperative (T-1), immediately after the operation (baseline (T0)), the first (T1), second (T2), third (T3), and seventh (T4) postoperative day.

Swelling measurement

Swelling was assessed by means of a five-line measurement using a flexible plastic tape measure (accuracy ±0.5 mm): (line 1) the most posterior point of the tragus to the most lateral point of the lip commissure, (line 2) the most posterior point of the tragus to the pogonium, (line 3) the most posterior point of the tragus to the lateral canthus of the eye, (line 4) the lateral canthus of the eye to the most inferior point angle of the mandible, and (line 5) the most inferior point angle of the mandible to the midpoint of the nasal bone (Fig. 1b). End points were marked using a fine waterproof felt tip pen.

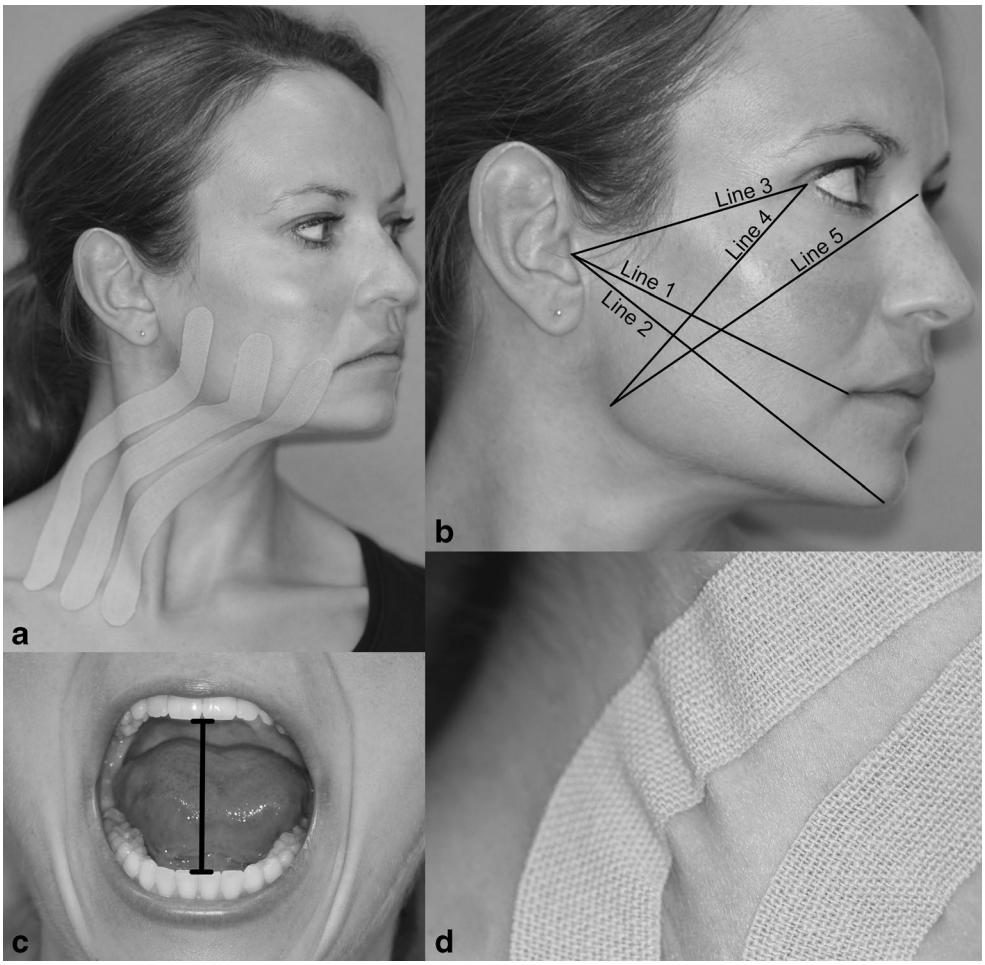

Fig. 1 **a** Kinesiologic tape application from supraclavicular to the point of maximum swelling. Tape stripes stimulate drainage of swelling and hematoma following the lymphatic duct. **b** Five-line measurement. Note, segment endpoints were marked to ensure accurate measurements. **c** Inter-incisor distance was measured using a caliper. **d** Convolutions below the taped area caused by the elasticity of the applied tape subsequently recoiling back to its original length following the application. It is believed that these convolutions increase the interstitial space between the skin and underlying connective tissue, thus promote the flow of blood and lymphatic fluid

Pain measures

Pain scores were assessed using a 10-level visual analog scale (VAS) subdivided in 10 mm increments, where 0 indicates no pain; 5, moderate pain; and 10, severe pain. Patients were asked to place a mark along the line to specify their pain sensation.

Trismus measures

The maximal mouth opening (maximum interincisal distance (IID)) was recorded using calipers (Fig. 1c).

Subjective outcome measures

Patients were asked to judge (1) whether they find the tape: not disturbing=1, slightly disturbing=2, or very disturbing=3; (2) whether the tape does not=1, only slightly=2, or significantly=3 interfere with their movements; (3) whether the degree of swelling was negligible=1, subtle=2, or severe=3; and (4) whether the taping therapy was very satisfying and convenient=1, satisfying=2, or not satisfying=3. Patients completed their questionnaires at the same time points as the rest of the measurements occurred.

Statistical analysis

All statistical analyses were performed using IBM SPSS Statistics software (Version 20.0). In addition to the descriptive statistics, between-group comparisons were conducted using the independent samples *t* test for differences in means and the chi-squared test for the gender distribution. The global significance level was set to 5 %, and all tests were two-sided. The primary endpoint of the study compared the change in facial surface (measured by the sum of lines 1 through 5) from T0 to T2 between the two study arms. All other statistical tests, namely the secondary endpoints of the study, were performed in an exploratory manner. The 95 % confidence intervals (CI) for mean swelling, trismus, and VAS measurements over time were also calculated and displayed graphically. Disturbance, movement, swelling (subjective outcome measures), and satisfaction were summarized for each category and time point. The reported results are the numbers for both observed sides (right and left) for each patient (n=40, 80 observations).

Supplementary statistical tests for the right and the left side separately, as well as for the sum of the left and right were also performed. However, since results provided no different or additional information, results were not discussed in the manuscript.

Results

Baseline characteristics

A total of 40 patients (20 in each group, 19 females, and 21 males) with bilateral impacted upper and lower third molars (80 observation sides) were randomly enrolled in the present study. Demographics and clinical characteristics at baseline of the 40 patients are listed in Table 1. No statistically significant differences were noted regarding gender, age and baseline measures of swelling, pain, and trismus ($p>0.05$).

Swelling

All swelling measurements were expressed as the mean sum of all five-line measurements (lines 1–5) for all patients and each side measured (in centimeter) at the six specific time points (Fig. 2a).

Changes in the swelling index between T0 and T1, T2, T3, and T4 varied significantly between the KT and the no-KT group: namely between T0 and T1 (KT, 0.6±1.5 cm; no-KT, 1.6±1.9 cm; $p=0.009$), T0 and T2 (KT, −0.8±1.8 cm; no-KT, 1.8±2.5 cm; $p<0.001$), T0 and T3 (KT, −1.7±1.7 cm; no-KT, 1.2±2.6 cm; $p<0.001$), and T0 and T4 (KT, −2.1±1.8 cm; no-KT, −0.8±1.9 cm; $p=0.002$). While the mean swelling increased between time points T0 to T2 in patients of the no-KT group (1.8±2.5 cm), the opposite was observed in the KT group (−0.8±1.8 cm).

Maximal swelling was defined as the difference between the maximal mean sum of all five-line measurements for all patients and the mean sum of all five-line measurements preoperatively (T-1). The maximal swelling value was larger in the no-KT group (4.6±2.2 cm) than in the KT group (2.9±1.8 cm), a difference that was statistically significant ($p<0.001$). Likewise, maximal swelling was reached on average at day 1.5 (Tmax) in the no-KT group and very early (day 0.9) in the KT group, which was statistically significantly different ($p<0.001$).

The differences between Tmax and 1 day after Tmax (Tmax+1) were calculated to assess the reduction of swelling, which was larger in the KT group (−1.5±0.9 cm) than in the no-KT group (−1.4±1.3 cm) and equivalent to a decrease in turgidity for 60 % during the first 2 days after surgery. Furthermore, the swelling index at the third postoperative day (T3) was reduced by less than 30 % in the no-KT group but had almost (90 %) returned to preoperative values (T-1) in the KT group. Since swelling was overall less pronounced in patients of the KT group (compared to the no-KT group), the reduction in swelling (between the two groups) is statistically not significant ($p=0.676$). Comparing the mean sum of all five-line measurements 1 day after the maximal swelling (Tmax+1) with the initial swelling at T0 highlighted that the patients in the KT group benefitted from a swelling reduction which was −0.5±1.1 cm below initial swelling after operation (T0). The extent of the swelling 1 day after the maximal swelling in the no-KT group remained high and exceeded the initial swelling of T0 by 1.1±2.1 cm. This difference in swelling reduction was statistically significant ($p<0.001$).

Table 1 Baseline patient characteristics

Characteristics	KT	no-KT	*P* value[a]
N	20	20	
Age	25.7±6.5	28.3±7.8	>0.05
Female gender	9	10	>0.05[b]
Male gender	11	10	>0.05
Swelling at T-1	61.5±5.2	61.3±4.8	>0.05
Swelling at T0	64.0±5.0	63.6±5.0	>0.05
VAS at T-1	0.3±0.8	0.8±0.8	>0.05
VAS at T0	2.1±2.3	2.8±2.1	>0.05
IID at T-1	4.3±1.0	3.7±0.9	>0.05
IID at T0	3.9±1.2	3.3±0.8	>0.05

Data presented as mean ± standard deviation (age, swelling, VAS, IID) and number of patients (gender)

[a] Independent samples *t* test, unless otherwise stated

[b] Chi-squared test

Pain

KT and the no-KT group results for pain scores assessed by means of a 10-level visual analog scale (VAS) are shown in Fig. 2b. The mean of all VAS scores for all patients showed no statistically significant difference ($p>0.05$) preoperatively (T-1) and directly after operation at the T0 measurement in the KT group (T-1, 0.4±0.9 cm; T0, 1.8±2.0 cm) and the no-KT group (T-1, 0.8±0.8 cm; T0, 2.7±2.1 cm). Although the mean sum of all VAS scores for all patients were low to moderate, patients of the KT group scored significantly ($p<0.001$) lower VAS values (T1, 2.3±2.2; T2, 1.4±2.0; T3, 0.9±1.5; T4, 0.5±1.2) compared to their no-KT counterparts (T1, 4.5±2.4; T2, 4.4±2.4; T3, 3.4±2.2; T4, 1.9±1.8).

Trismus

Mouth opening ability preoperatively (T-1) and at T0 did not differ in both groups ($p>0.05$); however, a statistically

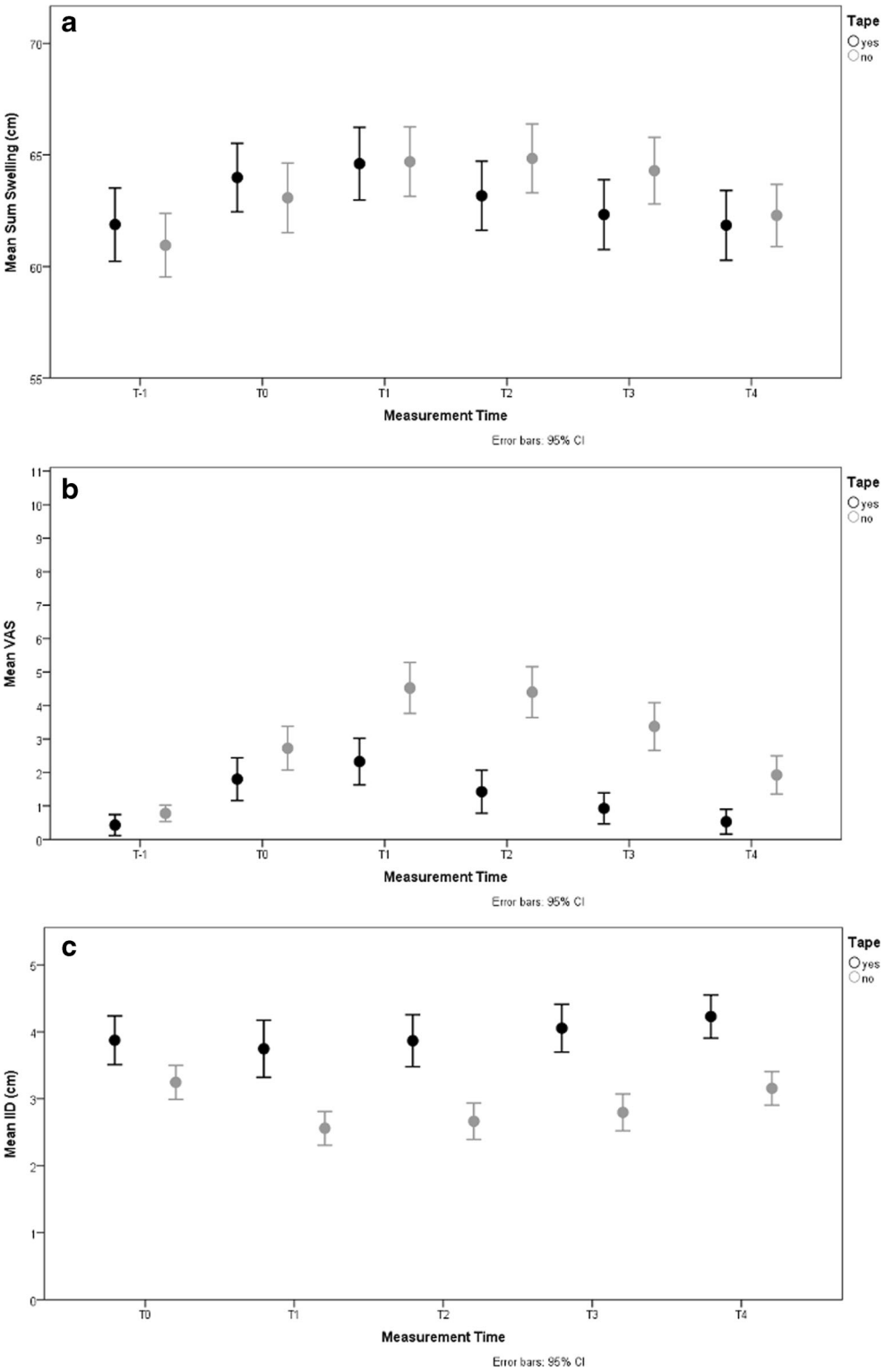

Fig. 2 **a** Mean sum and 95 % CI of all five-line measurements for all patients comparing KT (*black line*) and no-KT group (*gray line*) at six specific measurement times (*T-1* Preoperative, *T0* baseline directly after operation, *T1* first, *T2* second, *T3* third, and *T4* seventh postoperative day). **b** Mean and 95 % CI of VAS scores for all patients at six specific measurement times comparing KT (*black error bars*) and the no-KT group (*gray error bars*). Note, that for both groups patients scored moderate pain or less (VAS<5). **c** Mean and 95 % CI of IID scores for all patients at six specific measurement times comparing KT (*black error bars*) and the no-KT group (*gray error bars*)

significant amelioration in mean mouth opening ability was observed at T2 and T3 in the KT group (baseline value to T2, −0.1±0.5 cm; baseline value to T3, 0.2±0.6 cm) which was not the case in the no-KT group (baseline value to T2, −0.5±0.9 cm; baseline value to T3, −0.4±0.9 cm). Compared to the baseline, mouth opening at T1 and T4 differed in the KT group (T1, −0.2±0.5 cm; T4, 0.3±0.6 cm) and the no-KT group (T1, −0.6±0.9 cm; T4, −0.03±0.8 cm); however, these differences did not reach statistical significancy ($p > 0.05$) (Fig. 2c).

Patient self-assessment

Patient satisfaction scores were essentially interchangeable between the two groups at T0, but stark differences were observed from T1 onwards. Satisfaction rates steadily increased in patients from the KT group; conversely, in the no-KT group, dissatisfaction rose and peaked at T2 then declined (Fig. 3a, b). Analogous results were observed with the self-assessment of swelling, namely the no-KT group experienced proportionally more swelling (which peaked at T2) than the KT group (Fig. 3c, d). It should be noted that, overall, patients did not feel overly affected (in terms of restriction in movement and general disturbance) by the tape; however, discomfort seemingly increased slightly at the later time points (T3 and T4) (Fig. 3e, f).

Discussion

KT is thought to provide support to joints or muscles and therefore is frequently used in sports medicine to prevent or treat injuries. Despite the increased application of KT in clinical practice, its true merit has yet to be fully explored. Indeed, while some reports and case studies offer circumstantial evidence that KT influences swelling and hemorrhage rates, the vast majority fail to support the observed clinical effects with sound evidence-based results [16–18, 21, 22]. Postoperative swelling is a common event after surgery of impacted 3M affecting the social and working life of patients. Therefore, it is in the patient's interest to alleviate the postoperative discomfort after the surgery, and a multitude of studies have investigated

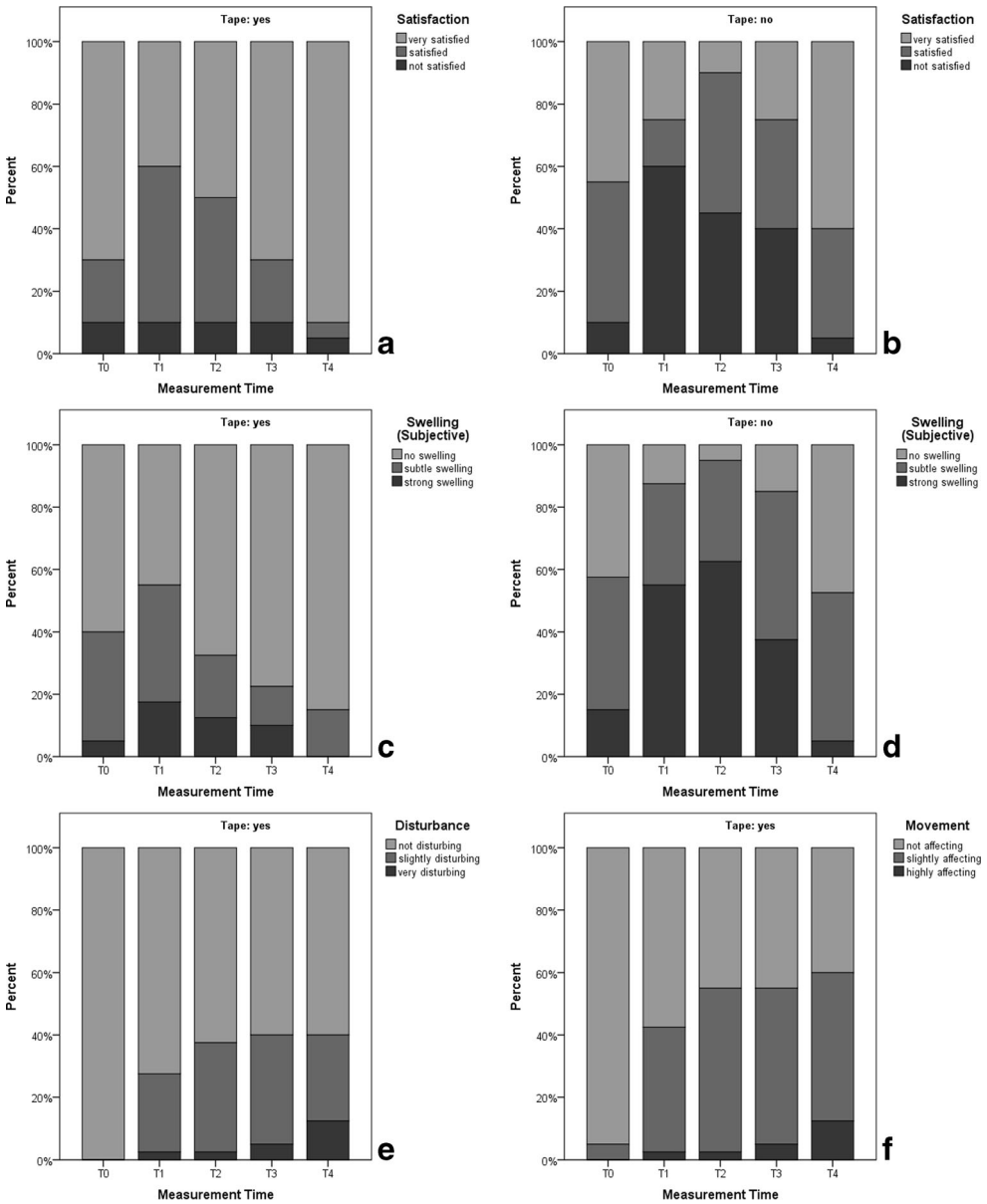

Fig. 3 **a**, **b** Satisfaction score for all patients in percentage at six specific measurement times comparing the KT group (panel **a**) and the no-KT group (panel **b**). Note, that on days 2, 3, and 4 after operation, patient satisfaction was higher in the KT than the no-KT group. **c**, **d** Subjective swelling scores for all patients in percentage at six specific measurement times comparing the KT group (panel **c**) and the no-KT group (panel **d**). Note, that patients sense a stronger swelling in the no-KT than the KT group at T2, T3, and T4. **e**, **f** Subjective KT evaluation score for all patients of the KT group in percentage. Shown is patient evaluation if they found the KT disturbing (panel **e**) and if KT affected them in their movements (panel **f**)

how best to control postoperative edema in oral surgery [9, 10, 23–25].

To the best of our knowledge, we are the first to report the clinical use of KT following the surgical removal of third molars (3M). The measurement of changes in facial volume is by no means trivial, and several methods have been described as being imprecise, complex, expensive, or difficult to standardize [26–28]. In an attempt to increase the objectivity and reliability, a modified method of linear measurements was applied to quantify time-resolved changes in facial volume. All measurements (notably all conducted by the same two investigators) utilized a series of data points, defined by landmarks encompassing the entire facial area of interest. By marking the segment endpoints, great care was taken to minimize technical variance.

The present study demonstrates that application of KT significantly influences tissue reactions and the rate of swelling. The primary endpoint, the postoperative increase of swelling at day 2 after surgery, was significantly lower in the KT group than the no-KT group. Very similar results were observed on day 3 as well. The maximum swelling typically occurs around the second postoperative day, which is in line with the results obtained from our control group. However, by applying KT, swelling peaked significantly earlier (within 24 h of surgery), and the reduction in magnitude was significantly faster (in excess of 60 % during the first 2 days after surgery). These findings are most likely due to KT's thickness (which is not dissimilar to human skin), adhesion, and stretch capacity. KT can stretch up to 140 % of its original length and subsequently recoils back to its original length. When applied correctly, this feature generates a pulling force resulting in the characteristic skin convolutions below the taped area (Fig. 1d), which in turn are thought to increase the interstitial space between the skin and underlying connective tissue, thus promoting the follow of blood and lymphatic fluid [14]. Furthermore, by using KT, maximal mouth opening ability recovered more rapidly, possibly due to the swelling receding faster and thereby alleviating skin tension.

Some have proclaimed that KT is able to decrease pain by reducing the pressure on nociceptors [11]. Both study groups received the same standardized postoperative analgesic drug therapy, which may explain why patients from both groups scored moderate to negligible pain (VAS<5) at all six time points investigated. Nevertheless (and also in agreement with other reports [29, 30]), statistically significant KT-dependant reduction of pain was observed in this study. Movement stretches KT; it adjusts its length to that of the skin only to an extent and thus deforms the skin. This constant impulse stimulates the skin and diverts patients' recognition detracting from pain and perception. In addition, based on the subjective scoring scheme, the perceived postoperative swelling was lower and overall satisfaction rate was higher in patients from the KT group. The present study design cannot exclude possible placebo effects, and therefore, we cannot proclaim with absolute confidence that KT is able to significantly reduce the perception of pain. Further targeted experimentation, for example by removing the effect of the standardized analgesic or by the provision of rescue drugs, is needed to substantiate this notion. Finally, it is conceivable that in some cases, the application of tape may irritate the skin, and similarly, some patients may show allergic reactions to the adhesives. Although no incidence of adverse reactions was observed in our study, this should be confirmed prior to any widespread and routine use.

Conclusion

The application of KT is simple, seemingly free from undesirable side effect and aids in the postsurgical recovery following 3M removal. With minimal investment (less than 2-euro cost of material per therapy), KT has the potential to significantly reduce the total number of sick days (due to the observed improvement in postoperative morbidity), extrapolated to the tens of millions of 3M operations conducted globally per annum demonstrates that the routine use of KT promises an economic return of substantial value.

Acknowledgments We thank the K-Active Europe GmbH for the donation of all K-Active Tapes® used in this study.

Conflict of interest The authors declare no potential conflicts of interests with respect to the authorship and/or publication of this article.

References

1. Friedman JW (2007) The prophylactic extraction of third molars: a public health hazard. Am J Publ Health 97(9):1554–1559. doi:10.2105/AJPH.2006.100271
2. Colorado-Bonnin M, Valmaseda-Castellon E, Berini-Aytes L, Gay-Escoda C (2006) Quality of life following lower third molar removal. Int J Oral Maxillofac Surg 35(4):343–347. doi:10.1016/j.ijom.2005.08.008
3. McGrath C, Comfort MB, Lo EC, Luo Y (2003) Changes in life quality following third molar surgery—the immediate postoperative period. Br Dent J 194(5):265–268. doi:10.1038/sj.bdj.4809930, discussion 261
4. Monaco G, Daprile G, Tavernese L, Corinaldesi G, Marchetti C (2009) Mandibular third molar removal in young patients: an evaluation of 2 different flap designs. J Oral Maxillofac Surg Off J Am Assoc Oral Maxillofac Surg 67(1):15–21. doi:10.1016/j.joms.2007.05.032
5. Pasqualini D, Cocero N, Castella A, Mela L, Bracco P (2005) Primary and secondary closure of the surgical wound after removal of impacted mandibular third molars: a comparative study. IntJ Oral Maxillofac Surg 34(1):52–57. doi:10.1016/j.ijom.2004.01.023
6. Chukwuneke FN, Oji C, Saheeb DB (2008) A comparative study of the effect of using a rubber drain on postoperative discomfort following lower third molar surgery. IntJ Oral Maxillofac Surg 37(4):341–344. doi:10.1016/j.ijom.2007.11.016

7. Sortino F, Cicciu M (2011) Strategies used to inhibit postoperative swelling following removal of impacted lower third molar. Dental Research Journal 8(4):162–171. doi:10.4103/1735-3327.86031
8. Carrillo JS, Calatayud J, Manso FJ, Barberia E, Martinez JM, Donado M (1990) A randomized double-blind clinical trial on the effectiveness of helium-neon laser in the prevention of pain, swelling and trismus after removal of impacted third molars. Int Dent J 40(1):31–36
9. Greenstein G (2007) Therapeutic efficacy of cold therapy after intraoral surgical procedures: a literature review. J Periodontol 78(5):790–800. doi:10.1902/jop.2007.060319
10. Szolnoky G, Szendi-Horvath K, Seres L, Boda K, Kemeny L (2007) Manual lymph drainage efficiently reduces postoperative facial swelling and discomfort after removal of impacted third molars. Lymphology 40(3):138–142
11. Kase K, Hashimoto T, Tomoki O (1996) Development of kinesio taping perfect manual. Kinesio Taping Association, Tokyo, pp 1–39
12. Kase K, Wallis J, Kase T (2003) Clinical therapeutic applications of the kinesio taping method, 2nd edn. Kinesio Taping Association, Tokyo
13. Kase K, Stockheimer KR (2006) Kinesio taping for lymphoedema and chronic swelling—Kinesio Taping Manual. Ken Ikai Co. Ltd., Tokyo, pp 1–172
14. Sijmonsma J, Trompert R, van der Veen T (2010) Lymph taping: theory, technique. Practice. Fysionair V.O.F, Oost, pp 1–44
15. Rai A, Datarkar A, Borle RM (2011) Are maxillomandibular fixation screws a better option than Erich arch bars in achieving maxillomandibular fixation? A randomized clinical study. J Oral Maxillofac Surg Off J Am Assoc Oral Maxillofac Surg 69(12): 3015–3018. doi:10.1016/j.joms.2010.12.015
16. Williams S, Whatman C, Hume PA, Sheerin K (2012) Kinesio taping in treatment and prevention of sports injuries: a meta-analysis of the evidence for its effectiveness. Sports Med 42(2):153–164. doi:10.2165/11594960-000000000-00000
17. Sahoo NK, Mohan R (2010) IMF screw: an ideal intermaxillary fixation device during open reduction of mandibular fracture. J Maxillofac Oral Surg 9(2):170–172. doi:10.1007/s12663-010-0049-0
18. Luhr HG (1987) Vitallium Luhr systems for reconstructive surgery of the facial skeleton. Otolaryngol Clin N Am 20(3):573–606
19. Garcia AG, Sampedro FG, Rey JG, Vila PG, Martin MS (2000) Pell–Gregory classification is unreliable as a predictor of difficulty in extracting impacted lower third molars. Br J Oral Maxillofac Surg 38(6):585–587. doi:10.1054/bjom.2000.0535
20. Leonard MS (1992) Removing third molars: a review for the general practitioner. J Am Dent Assoc 123(2):77–78, 81–82, 85–86
21. Chou YH, Li SH, Liao SF, Tang HW (2012) Case report: manual lymphatic drainage and kinesio taping in the secondary malignant breast cancer-related lymphedema in an arm with arteriovenous (A-V) fistula for hemodialysis. Am J Hosp Palliat Care (Epub Ahead Of Print). doi:10.1177/1049909112457010
22. Tsai HJ, Hung HC, Yang JL, Huang CS, Tsauo JY (2009) Could kinesio tape replace the bandage in decongestive lymphatic therapy for breast-cancer-related lymphedema? A pilot study. Support Care Cancer Off J Multinatl Assoc Support Care Cancer 17(11):1353–1360. doi:10.1007/s00520-009-0592-8
23. Rana M, Gellrich NC, Ghassemi A, Gerressen M, Riediger D, Modabber A (2011) Three-dimensional evaluation of postoperative swelling after third molar surgery using 2 different cooling therapy methods: a randomized observer-blind prospective study. J Oral Maxillofac Surg Off J Am Assoc Oral Maxillofac Surg 69(8): 2092–2098. doi:10.1016/j.joms.2010.12.038
24. Markiewicz MR, Brady MF, Ding EL, Dodson TB (2008) Corticosteroids reduce postoperative morbidity after third molar surgery: a systematic review and meta-analysis. J Oral Maxillofac Surg Off J Am Assoc Oral Maxillofac Surg 66(9):1881–1894. doi:10.1016/j.joms.2008.04.022
25. Kim K, Brar P, Jakubowski J, Kaltman S, Lopez E (2009) The use of corticosteroids and nonsteroidal antiinflammatory medication for the management of pain and inflammation after third molar surgery: a review of the literature. Oral Surg Oral Med Oral Pathol Oral Radiol Endod 107(5):630–640. doi:10.1016/j.tripleo.2008.11.005
26. Bjorn H, Lundqvist C, Hjelmstrom P (1954) A photogrammetric method of measuring the volume of facial swellings. J Dent Res 33(3):295–308
27. Milles M, Desjardins PJ, Pawel HE (1985) The facial plethysmograph: a new instrument to measure facial swelling volumetrically. J Oral Maxillofac Surg Off J Am Assoc Oral And Maxillofac Surg 43 (5):346–352
28. Van Gool AV, Ten Bosch JJ, Boering G (1975) A photographic method of assessing swelling following third molar removal. Int J Oral Surg 4(3):121–129
29. Gonzalez-Iglesias J, Fernandez-de-Las-Penas C, Cleland JA, Huijbregts P, Del Rosario Gutierrez-Vega M (2009) Short-term effects of cervical kinesio taping on pain and cervical range of motion in patients with acute whiplash injury: a randomized clinical trial. J Orthop Sports Phys Ther 39(7):515–521. doi:10.2519/jospt.2009.3072
30. Thelen MD, Dauber JA, Stoneman PD (2008) The clinical efficacy of kinesio tape for shoulder pain: a randomized, double-blinded, clinical trial. J Orthop Sports Phys Ther 38(7):389–395. doi:10.2519/jospt.2008.2791