# *MODIFIED BUTTERFLY ANTI-TENSION TAPE AS A PREVENTION OF HYPERTROPHIC SCAR IN FACIAL REGION MEASURED BY JAPANESE SCAR SCALE (JSS)*

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## *ABSTRACT*

***Introduction:*** *Abnormal scar remains an unsolved problem in some countries marked by an increase of prevalence of abnormal scar in the last 2 to 3 decades. Prevention of abnormal scar is essential but there aren't many therapy modalities as prevention followed by affordable prices to all society groups for abnormal scar.****Purpose:*** *to determine the effect of anti-tension tape in the shape of a butterfly as a hypertrophic scar prevention measured by Japanese Scar Scale (JSS).* ***Method:*** *This is an analytic study with an observational study design and a cohort study method. Total sample used in this study is 80, divided into 2 groups contains 40 patients who got anti tension tape application and patient who didn't. The anti tension tape was used for 3 months. Chi-Square was used as a statistical analysis in this study.* ***Results:*** *From 40 samples in anti-tension tape application group, 33 patients have normal scar, 7 patients have hypertrophic scar. From 40 patients in control group, 11 patients have normal scar and 29 patients have hypertrophic scar. Statistical analysis using chi-square showed p=0.000.* ***Conclusion:*** *Modified butterfly anti-tension tape can be used as on therapy modality as a prevention of Hypertrophic scar measured by Japanese Scar Scale*

***Keywords :*** *Hypertrophic Scar, Wound Healing, Butterfly Anti-Tension Tape*

## ABSTRAK

**Pendahuluan:** Jaringan parut abnormal masih menjadi masalah yang belum terpecahkan di beberapa negara yang ditandai dengan peningkatan prevalensi jaringan parut abnormal dalam 2 sampai 3 dekade terakhir. Pencegahan parut abnormal sangat penting tetapi tidak banyak modalitas terapeutik karena harga yang tidak terjangkau untuk semua masyarakat. **Tujuan:** untuk mengetahui pengaruh plester anti tegangan berbentuk kupu-kupu sebagai pencegahan parut hipertrofik yang diukur dengan Japanese Scar Scale (JSS). **Metode:** Penelitian ini merupakan penelitian analitik dengan desain penelitian observasional dan metode penelitian kohort. Jumlah sampel yang digunakan dalam penelitian ini adalah 80 yang terbagi menjadi 2 kelompok yang terdiri dari 40 pasien yang mendapat aplikasi plester anti tegangn dan pasien yang tidak. Plester anti tegangan digunakan selama 3 bulan. Chi-Square digunakan sebagai analisis statistik dalam penelitian ini. **Hasil:** Dari 40 sampel kelompok aplikasi plester anti tegangan, 33 pasien memiliki bekas luka normal, 7 pasien memiliki parut hipertrofik. Dari 40 pasien dalam kelompok kontrol, 11 pasien memiliki bekas luka normal dan 29 pasien memiliki parut hipertrofik. Analisis statistik menggunakan chi-square menunjukkan p=0,000. Kesimpulan: Modifikasi plester anti tegangan berbentuk kupu-kupu dapat digunakan sebagai modalitas terapi untuk pencegahan parut hipertrofik yang diukur dengan Japanese Scar Scale

**Kata kunci: Parut Hipertrofik, Penyembuhan Luka, Plester Anti Tegangan**

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## INTRODUCTION

Due to high incidence of tissue trauma caused by accidents or surgery, abnormal scar remains an unsolved problem in some countries. According to recent research, the prevalence of abnormal scar has grown in the last 2 to 3 decades (Udo-Affah, G. U, Eru, E. M, Idika, C. I. Uriakpa, J. C, Njoku, 2014). Abnormal scar occurs in 40% to 70% of postoperative wounds, depending on the lesion's shape. The emergence of this abnormal scar indirectly impacts the individual's quality of life, particularly in terms of aesthetics. There are two types of abnormal scars: hypertrophic scars and keloids (Huang *et al.*, 2013). Scars that form 4-8 weeks following the wound healing process, followed by a period of fast wound growth lasting up to six months, are known as hypertrophic scars. Hypertrophic scars typically have wound characteristics that do not extend beyond the original wound line. Hypertrophic scars also regress on their own after a few years. Keloids are scars that can form years after a trauma or wound healing. Keloids have wound characteristics that extend beyond the original wound line. Keloids do not regress on their own (Son and Harijan, 2014).

Prevention of abnormal scar is critical in wound care, even constituting the main of the therapy. The prevention of abnormal scar begins throughout the surgical procedure. There aren't many acceptable therapy modalities as prevention therapy followed by affordable prices to all society groups, especially since cosmetic characteristics that aren't covered by state-owned health insurance (BPJS) are one of the factors contributing to the high occurrence of abnormal scarring (Perdanakusuma, 2017). A hypertrophic scar is one type of abnormal scar that appears 4-8 weeks after the wound healing process and is followed by a period of accelerated wound expansion lasting up to six months. Laksono et al. discovered that efforts to prevent abnormal scar using modified anti-tension plasters yielded positive outcomes with a p-value of 0.03 (Laksono *et al.*, 2019).

Abnormal scar is caused by a number of factors. These factors are classified as either local or systemic. The high tension between the wound edges is one of the local factors influencing the appearance of abnormal scars. The presence of excessive tension has consequence: it prolongs the inflammatory phase (Ogawa, 2017). This prolongation of the inflammatory phase causes delayed wound healing. Several pro-inflammatory cytokines, such as CD41 and T-helper cells, are over-expressed during this prolongation of the inflammatory process. The overexpression of these pro-inflammatory cytokines affects the increase in interleukin and interferon, which causes an increase in fibrogenesis activity. It is hoped that modified the anti-tension tape will make the wound less stressed, and the healing process will be sped up (Gauglitz and Korting, 2011).

On the other hand, the hypoxic state will stimulate the emergence of HIF-1, which affects the inflammatory response by switching metabolic functions to glycolysis. Hypoxia-Inducible Factor-1 (HIF-1) is also a macrophage activity regulator during the

inflammatory process. HIF-1 also has a stimulating effect on the angiogenesis process. During the angiogenesis process, HIF-1 increases VEGF expression, a powerful angiogenic factor. As mentioned earlier, reveals wound tension requires special attention in order to prevent abnormal scarring. The reduction of tension in the wound must be properly controlled because a prolonged and excessive reduction of tension will result in HIF-1 overexpression, which will result in abnormal scars (Ruthenborg *et al.*, 2014).

There are numerous instruments available today that can be used to assess the quality of scars. The Vancouver Scar Scale (VSS), Manchester Scar Scale (MSS), Visual Analog Scale (VAS), and Patient and Observe Scar Assessment Scale are among the existing instruments (POSAS). The Vancouver Scar Scale (VSS) is the most common used instrument by clinicians to assess hypertrophic and keloid scars due to its ease of use. The VSS, on the other hand, is a scar assessment instrument designed to evaluate burn scars rather than hypertrophic scars and keloids. Another weakness of VSS is that it only assesses scars based on the condition of the wound, rather than subjective complaints felt by the patient, as POSAS does. In 2015, the Japanese Scar Workshop released the Japanese Scar Scale, a scar assessment tool for hypertrophic scars and keloids (Fearmonti *et al.*, 2010). This study aims to determine the effect of anti-tension tape in the shape of a butterfly as a hypertrophic scar prevention.

## METHODS

An analytic study with an observational study design and a cohort study method was used in this study. This study included all men and women with age of 0-70 who had postoperative suturing wounds in the facial region at the Plastic Surgery Polyclinic at two private hospitals in Malang. In this study, 80 people were divided into two groups: those who applied anti-tension tape and those who did not apply anti-tension tape.

Men and women between the ages of 0 and 70 were eligible for this study if they had facial wounds that had been sutured two weeks prior. Patients who were on steroid medication, who had a history of the immunocompromised disease, who had a history of diabetes mellitus, and who were obese were excluded from this study. The Japanese Scar Scale instrument was used to assess scar quality three months after the application of anti-tension tape.

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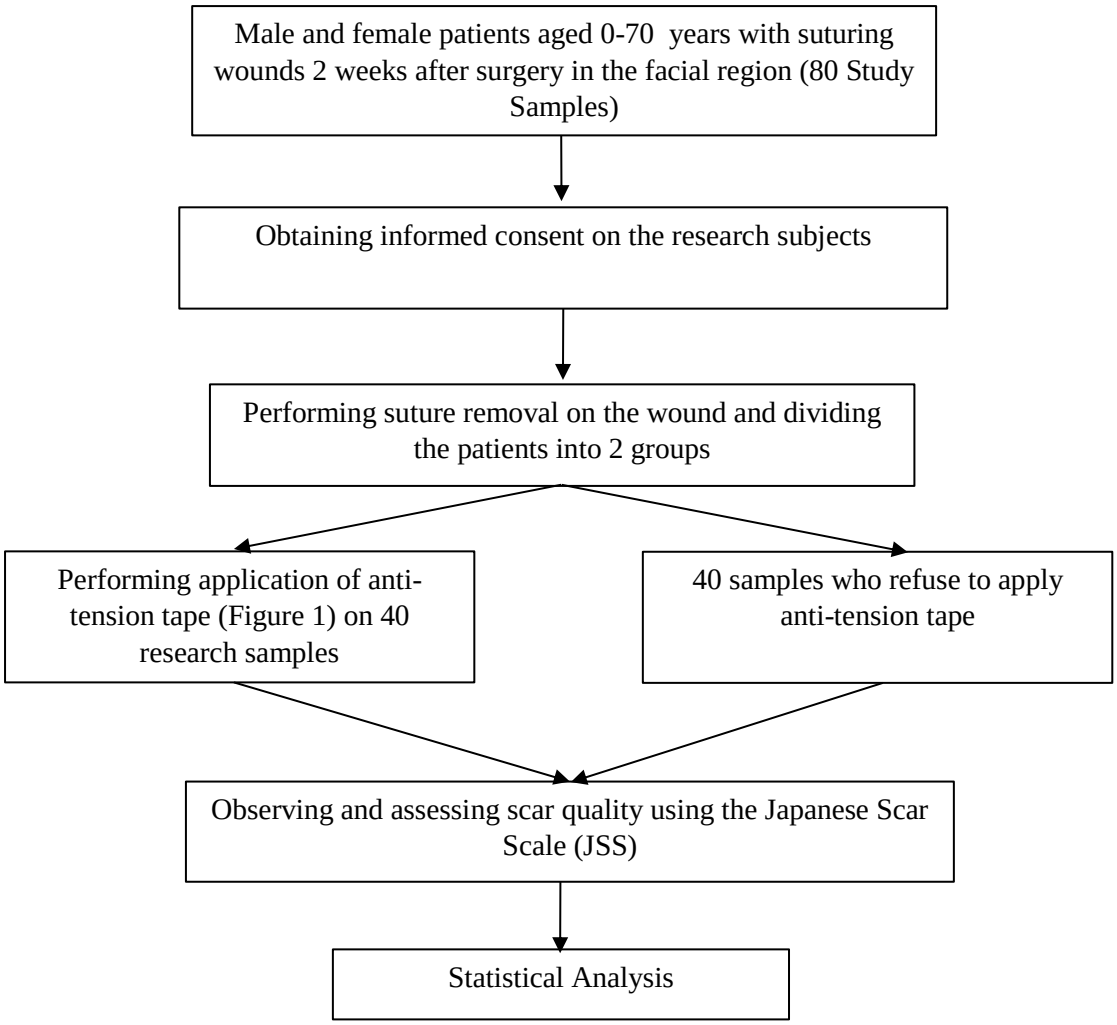


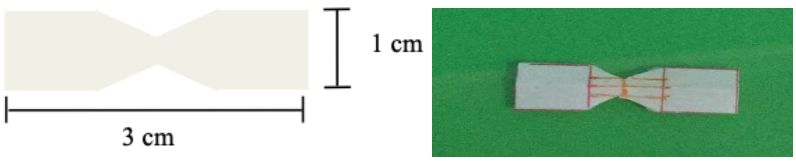


**Figure 1. Butterfly Anti Tension Tape Design**

## RESULTS

**Table 1. Study Characteristics**

| Characteristics | Normal (n = 44) | Hypertrophic (n = 36) | p-value |
|---|---|---|---|
| **Mean (± SD)** | | | |
| **Age of Participants** | 43.86 (± 15.761) | 28.83 (± 9.437) | 0.000 |
| **n (%)** | | | |
| **Age Group** | | | |
| **0-30 y/o** | 10 (22.73%) | 24 (66.67%) | 0.000 |
| **31-60 y/o** | 20 (45.45%) | 12 (33.33%) | |
| **≥61 y/o** | 14 (31.82%) | 0 (0%) | |
| **Risk Factor (Family History)** | | | |
| **Exist** | 6 (13.64%) | 34 (94.44%) | 0.000 |
| **Non-existent** | 38 (86.36%) | 2 (5.56%) | |

This study enlisted the participation of 80 people. According to the participant age profile, participants with normal wound healing had a mean age of 43.86 (15.761) years, while participants with hypertrophic scars had a younger mean age of 28.83 (9.437) years (p-value = 0.000). Ten people (22.73 percent) with normal wound healing were between the ages of 0 and 30. The majority of participants in the normal group were between the ages of 31 and 60 (20 people (45.45 percent)). Fourteen participants in the normal group were aged 61 years (14 (31.82%)). On the other hand, most of the participants with hypertrophic scars aged 0-30 years were 24 people (66.67%). Twelve other participants in this group aged 31-60 years. The number of participants with male sex in the normal group was 21 people (47.73%), while in the hypertrophic group 15 (41.67%) (p=0.588). In the normal group, 6 people (13.64%) of participants had risk factors in the family, while 38 people (86.36%) did not have a clear family history. In the hypertrophic group, 34 participants (94.44%) had a family history, but 2 (5.56%) did not (p-value=0.000).

**Table 2. Relationship between Types of Therapy on JSS Categories**

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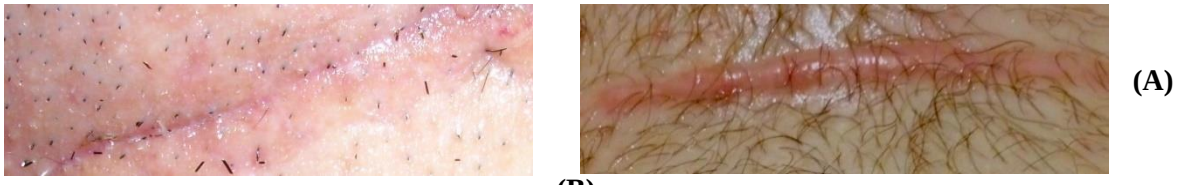
| | | JSS Categories | | Total | p-value |
|---|---|---|---|---|---|
| | | Normal | Hypertrophic | | |
| **Treatment** | Intervention | 33 | 7 | 40 | 0.000 |
| | Non-Intervention | 11 | 29 | 40 | |
| **Total** | | 44 | 36 | 80 | |

Table 2 demonstrates a significant relationship between the therapies of participants. In the intervention group, 33 people (82.5 percent) experienced normal wound healing. In the non-intervention group, only 11 people (27.5 percent) experienced hypertrophic wound healing (p=0.000).



**(A)**

**(B)**

**Figure 2. (A) Scar after the surgeon remove the suture (B) Evaluation of Scar: Hypertrophic scar found 3 months after without butterfly anti-tension tape (JSS Score: 14)**

**Figure 3. (A) Scar after the surgeon remove the suture (B) Evaluation of Scar: Good scar condition found 3 months after without butterfly anti-tension tape (JSS Score: 4)**

**Table 3. Relationship between Participants' Age and JSS Category**

| | | JSS Categories | | Total | p-value |
|---|---|---|---|---|---|
| | | Normal | Hypertrophic | | |
| **Participants' Age** | 0-30 | 10 | 24 | 34 | 0.000 |
| | 31-60 | 20 | 12 | 32 | |
| | ≥61 | 14 | 0 | 14 | |
| **Total** | | 44 | 36 | 80 | |

Table 3 shows a significant relationship between participant age categories and wound healing outcomes based on JSS category. In the 0-30 year age group, 10 people (22.73 percent) had normal healing, while 24 people (66.67 percent) had hypertrophic wound healing. In the 31-60 year age group, 20 participants (45.45 percent) experienced normal wound healing, while 12 participants (33.33 percent) experienced hypertrophy. Fourteen participants (31.82 percent) in the 61-year-old age group recovered normally (p=0.000).

**Table 4. Relationship between Family History to JSS Category**

| | | JSS Categories | | Total | p-value |
|---|---|---|---|---|---|
| | | Normal | Hypertrophic | | |
| **Risk Factor (Family History)** | **Exist** | 6 | 34 | 40 | 0.000 |
| | **Non-existent** | 38 | 2 | 40 | |
| **Total** | | 44 | 36 | 80 | |

The significant relationship between familial tendencies and wound healing by JSS category is shown in Table 4. As many as 6 participants (13.64 percent) in the normal group had family risk factors, while 38 participants (86.36 percent) did not. Meanwhile, 34 participants (94.44 percent) in the hypertrophic group had family risk factors, while 2 (5.56 percent) did not (p=0.000).

Many factors influence the process of wound healing and scar formation, so these factors are classified as local and systemic. Local factors have an immediate impact on the wound's characteristics, whereas systemic factors have an impact on the body's ability to heal the wound. Age, sex hormones, stress, and chronic disease are systemic influencing factors (Hardman and Ashcroft, 2008; Son and Harijan, 2014; Castranova *et al.*, 2016).

**DISCUSSION**

According to the data obtained in this study, the study sample's average (mean) age is 43 in normal group and 28 in hypertrophic groups. This study also discovered that hypertrophic scars were more common in the 0-30 age group, followed by 31-60 age group and ≥61 age group. This data is consistent with the findings of a study conducted by Colboc (2020) (Colboc and Meaume, 2020) , which stated that active collagen activity occurs at a young age, implying that scars are more likely to appear in younger age groups. This data is also supported by Perdanakusuma's (2020) research, which shows that of 105 samples of abnormal scars occurring between the ages of 17 and 55 years, with a total of 95 samples, only 10 people over the age of 60 years experienced abnormal scars (Wardani, Peradanakusuma and Indramaya, 2021). There has been a decrease in hormonal activity in the form of estrogen in the elderly, which affects the inhibition of the wound healing process. According to Colboc (2020), the quality of scars in elderly is also better. This is due to a significant decline in the function of mast cells in the elderly. During the remodeling phase, mast cells influence collagen maturation. Mast cell activation causes the release of profibrotic molecules and other mediators that stimulate fibroblasts. Mast cells also produce VEGF, which is a key factor in the formation of abnormal scars (Colboc and Meaume, 2020).

In this study, there's a significant relationship between family history and hypertrophic scar with p=0.000. From patient's group with hypertrophic scar, there are 34 patients with family history whereas from normal scar group there are 38 patients with no history of hypertrophic scar in family. This data is consistent with the result from study by Cortez *et al* (2017) that showed ASAH1 gene found as a abnormal scar formation with significant statistical analysis (Santos-Cortez *et al.*, 2017).

In this study, statistical analysis using chi square yielded significant results with a p-value of 0.000. This is consistent with the findings of a study conducted by Laksono (2017) on 36 patients with wounds using modified hypafix plasters to prevent abnormal scarring, which yielded a p-value of 0.03(Laksono *et al.*, 2019). Another study, conducted by Atkinson (2005), found that using paper tape to prevent abnormal scarring had positive results (Atkinson *et al.*, 2005).

Both hypoxia and hyperoxia, the opposites, can play a role in developing abnormal scarring. The prolongation of the inflammatory phase causes a delay in wound healing. The presence of an immune response during the wound healing process and the prolongation of the inflammatory phase are factors that contribute to the formation of hypertrophic scars and keloids. Immune responses produced during the inflammatory process, particularly the overexpression of Th1 and CD41, are linked to the fibrosis process via the production of interferon and IL-12. Overexpression of these pro-inflammatory cytokines influences the increase in interleukin and interferon, which leads to an increase in fibrogenesis activity (Pozos, 2014; Andrews *et al.*, 2016; Laksono *et al.*, 2019). Preventing

hypoxic conditions also prevents excessive HIF-1 activity, which prevents excessive angiogenesis. The use of anti-tension tape for three months aims to prevent hypoxia, but it also aims to control oxygen consumption in the wound so that it enters a hyperoxia state. Excessive VEGF production can be caused by a hyperoxia state, which causes excessive oxygen consumption and, as a result, excessive angiogenesis. Angiogenesis causes excessive vascularization in the wound healing area in hypertrophic scar (Bishop, 2008; Huang *et al.*, 2013; Ogawa and Akaishi, 2016).

An imbalance in collagen synthesis and degradation is another cause of hypertrophic scarring. Collagen is necessary for wound healing, but hypertrophic scars have an excess of type III collagen, whereas keloid scars have an excess of both type I and type III collagen. Collagen enzymes influence collagen degradation, whereas hydroxyproline enzyme levels influence collagen synthesis and formation (Unahabhokha *et al.*, 2015; Andrews *et al.*, 2016; Ogawa, 2017). Tejiram (2016) discovered that minimal tension wounds reduced the production of hydroxyproline. This happens about 2-3 weeks after the wound tension is reduced (Tejiram *et al.*, 2017).

Wound tension has been shown in many studies to influence the activity of fibroblasts and keratinocytes. According to Jiang (2016) the increase in extracellular matrix activity, as measured by the expression of collagen I, III, and changes in fibronectin, is also affected by wound tension. The activity of calcium-dependent serine protein kinase-1 (CASK-1) was also discovered, which has an inhibitory effect on fibroblasts. There was a decrease in fibroblast inhibition and an increase in type I collagen when CASK-1 expression was low. There was a decrease in CASK-1 expression under conditions of high wound tension (Jiang *et al.*, 2016).

In this study, the Japanese scar scale measurement instrument was used to assess scar quality. According to Ogawa's (2020) research, other instruments such as the Vancouver Scar Scale (VSS), Manchester Scar Scale (MSS), and Patient and Observer Scar Assessment (POSAS) only have scar quality parameters based on numbers, with no scoring classification of abnormal scars, either hypertrophic or keloid. Furthermore, the use of the other instruments mentioned above is widely used to assess the quality of burn scars. Since 2015, this JSS instrument has been widely used in scar research in many countries (Ogawa *et al.*, 2011).

There are several weaknesses that found in this study such as patient's wound sizes are not all the same, ideally research is carried out on the same wound size, because wound size affects collagen activity. Patient's disobedient which could not be identified by the researcher in terms of the tape usage that affected the results of the study

## CONCLUSION

Modified butterfly anti tension tape can be used as on of modalities to prevent occurence of abnormal scars, especially hypertrophic scars

with p=0.000 measured by Japanese Scar Scale (JSS).

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