

ORIGINAL ARTICLE

TOPICAL ZINC OXIDE ADHESIVE TAPE FOR KELOID MANAGEMENT

By

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Aim: This prospective study aimed to determine efficiency, safety of topical zinc oxide adhesive tape (Zn-Tape) as 1st line of keloid therapy and adjuvant use of corticosteroid or surgery as 2nd line and zinc oxide, corticosteroid & surgery as 3rd line for unresponding cases.

Methods: Fifty-three patients were recruited from Plastic & Reconstruction Surgery Unit, King Abdulaziz University Hospital, Jeddah, Saudi Arabia (2000-2005). All patients applied Zn-tape as monotherapy if no improvement a combination therapy of Zn-Tape with corticosteroid or surgical or both was started. Pre- and post-treatment scar (height, pliability, erythema, pigmentation, pruritus) and patient satisfaction values were scored and compared.

Results: 34.0% of patients responded to monotherapy (Zn-Tape), 34.0% needed ditherapy (Zn-tape & corticosteroid; Zn-tape & surgery), 32.0% required tritherapy (Zn-Tape, surgery & corticosteroid). With Zn-Tape & surgery and with Zn-Tape, corticosteroid & surgery improvement was 100%, patient satisfaction was 88.9% with Zn-Tape & surgery. Best improvement of itching was noticed with Zn-Tape; pigmentation, erythema, size with Zn-Tape & surgery; pliability, flattening with Zn-Tape, corticosteroid & surgery. Recurrence rate was 5.7%.

Conclusions: Zn-Tape is effective when used as monotherapy with low recurrence. In unresponsiveness cases to Zn-Tape addition of corticosteroid or surgery or both proven to be effective.

Keywords: Keloid, multimodalities treatment, corticosteroid, surgical excision.

INTRODUCTION

Keloid represents benign exuberant forms of scar formation. It consists of excessive amounts of thick, densely packed eosinophilic collagen bundles in focal or irregular pattern and few fibroblasts.⁽¹⁾ Clinically, they extend beyond confines of original wound, do not regress spontaneously, and tend to recur after excision.⁽²⁾

Keloids can cause physical disfigurement, restricted range of motion, distressing symptoms, psychological problems, and yet there is no consensus in literature regarding appropriate therapy.⁽³⁾ Many treatment modalities have been described with contradictory results⁽²⁾ such as intralesional (IL) injections of corticosteroids⁽⁴⁾ or 5-fluorouracil,⁽⁵⁾ surgical excision,⁽⁶⁾ cryotherapy,⁽⁷⁾ radiotherapy,⁽⁸⁾ pressure therapy,⁽⁹⁾ silicone gel sheeting⁽¹⁰⁾ and laser treatment.⁽¹¹⁾

An adhesive zinc tape (Zn-Tape) is believed to be useful in wound management in certain cases. Good results have been obtained particularly in treatment of burns,⁽¹²⁾ fingertip amputations,⁽¹³⁾ lower leg and foot ulceration^(14,15), and keloids^(14,16). Zinc is absorbed from zinc tape applied to opened wound.⁽¹⁷⁾ It had been reported that fewer keloids developed when Zn-Tape is used in wound dressing compared with classical dressings.⁽¹⁸⁾

The aim of this prospective study was to determine safety, efficacy of topical application of zinc oxide adhesive tape as 1st line of keloid treatment, to evaluate the adjuvant effect of either corticosteroid or surgical excision in cases of zinc oxide tape with non satisfactory result.

PATIENTS AND METHODS

Over period of 5 years (January 2000 to January 2005), 53 patients (15 males, 38 females); with keloid received treatment at Plastic and Reconstructive Surgery Unit, King Abdulaziz University Hospital, Jeddah, Saudi Arabia were recruited in this study. Patients age ranged from 3-53 years (mean \pm SD, 20.7 \pm 11.2 years), their skin colors were white (n=16), brown (n=33) and black (n=4). All adult patients and parents of children patients gave informed consent. King Abdulaziz University Committee approved the study. Following demographic and clinical information were collected from patients; age, sex, nationality, skin color (black, brown, white), medical history, family history of similar or related conditions, associated symptoms (pruritus). Following data were recorded for each scar: cause, anatomical location, characteristics of scar (height, pliability, color, size, flattening and pigmentation). In order to eliminate confounding effects from other therapies, cases were only included if at least 6 months had passed since previous treatment (s).

After explanation to each patient or parents regarding the difficulties and complications in management of such type of scars, special regimen of treatment was started. Keloid treatment was started by 1st line (monotherapy, e.g. Zn-Tape). Commercially available Zn-Tape (Leukoplast, Registered Trademark of BDF, Beiersdorf AG Germany) made of cotton web with adhesive substance (resin, zinc oxide). Zn-Tape was applied to entire scar surface and margin of surrounding intact skin and kept on day and night, changed every two to three days. After 4 weeks of beginning of treatment, response to Zn-Tape therapy was evaluated, if there is general improvement patient well continues same therapy for three months up to one year. Clinical improvement was defined by improvement in scar height, erythema, pliability, pigmentation, size and improvement of patients' symptoms (self-assessed pruritus).⁽¹⁹⁾ If no improvement or satisfaction or development of complication, then patient will receive 2nd line (Ditherapy in the form of Zn tape and corticosteroid or zinc tape and surgical excision) as adjuvant therapy. Corticosteroid (triamcinolone acetone, TAC) in concentrations of 10-40 mg/mL according to scar size administered intralesionally at mid point of the scar with a 25- to 27-gauge needle at 4 week intervals¹⁶ for 5 months in combination with Zn-Tape dressing and then monthly injection for another 4-6 months after symptomatic relief as prophylaxis to prevent recurrence. Surgical excision was decided for large scar, unresponsive to Zn-Tape or for cosmetic appearance. Surgical excision was performed under general anesthesia in children and local anesthesia (2% Xylocan with 1:200,000 adrenalin) in adults, dose of anesthesia depends on patient's age and lesion size. All surgical excision was performed by intralesional excision (marginal excision while retaining a rim) of the keloid has been recommended to decrease recurrence rates efforts

were made to reconstruct involved wounds with no tension.⁽²⁰⁾ If still no good response obtains after usage of corticosteroid or surgical excision in addition to Zn-Tape, 3rd line of therapy would begin by using the three modalities (tritherapy, Zn-Tape, corticosteroid & surgery). Corticosteroid can be used preoperatively, intraoperatively or postoperatively depending on clinical findings and keloid size, patients were followed up as mentioned above.

All the patients were evaluated by the author at each visit during treatment and follow-up periods. The cutaneous changes were noted. Photographs were taken at baseline and at every visit. Findings for clinical parameters and patients' symptoms were recorded at baseline and during treatment follow-up. Scar height (maximum vertical elevation of scar above normal skin) was measured in millimeters. Scar flattening percentage was defined as percentage reduction of scar height from baseline to end of treatment. Flattening was classified using following scale: complete flattening (100%), highly significant flattening (>90%), significant flattening (75-90%), moderate flattening (50-75%), minimal flattening (<50%). Scar pliability assessed functional mobility of scars¹⁹ was grading, normal, soft and firm. Scar erythema was graded according to severity with 0 = absent, 1 = mild, 2 = moderate, 3 = severe. Scar pigmentation was grading according to severity pigmented, normal color, reduced or no changed. Self-assessed symptoms were done by asking patients to grade their symptoms of pruritus. Incidence of recurrence during follow up period was recorded.

Statistical analysis: Statistical analysis was carried out using Statistical Package for Social Sciences (SPSS)-software version 12 (Chicago, USA). Data were represented as number (percentage) or mean \pm SD. Pre- and post-treatment mean values for scar height, pliability, erythema, pruritus, pain were calculated and compared. Calculation of p value between variable were performing using Person's Chi-squared test. A p<0.05 was considered to be significant.

RESULTS

Table 1. showed demographic and clinical characteristics of patients. Numbers of patients were significantly elevated in female than male (71.7% versus 28.3%, p<0.01), brown than white and black colored skin patients (62.3% versus 30.2% and 7.5%, p<0.000), those with negative than positive family history (88.7% versus 11.3%, p<0.000). All patients were on Zn Tape as 1st line of treatment (monotherapy), when 1st line failed patients began 2nd line of treatment (ditherapy) and if 2nd line failed patients began 3rd line of treatment (tritherapy). Patients on one (Zn-Tape), two (Zn-Tape & corticosteroid or Zn-Tape & surgery) and three treatments (Zn-Tape & corticosteroid or Zn-Tape & surgery) were (34.0%, 34.0%, 32.1%, p<0.000). Disease duration, treatment duration and scar diameter

were [mean±SD (range), 4.20±4.57 (0.5-21.0) years; 13.38±6.48 (6-24) months; 2.11±0.87 (1-4) cm]. Recurrence rate was 5.7%.

Patient who were treated satisfactory with Zn-Tape as monotherapy (n=18) or Zn-Tape & corticosteroid (n=9), or Zn-Tape & surgery (n=9) or Zn-Tape, corticosteroid & surgery (n=17). There were no significant different in age, nationality, gender, skin color and family history between patients on different lines of treatments (p>0.05) Table 2.

Table 3. showed scar characteristics according to treatment. Preferred therapy for face, leg was Zn-Tape (9.5%, 19.0%); chest, foot was Zn-Tape & corticosteroid (27.3%, 9.1%); neck, trunk was Zn-Tape & surgery (22.2% for both); ear, arm, deltoid was Zn-Tape, corticosteroid & surgery (25.0%, 15.0%, 15.0%). Treatment of choice in burn and infection was Zn-Tape (33.3%, 22.2%); post surgical wound was Zn-Tape & corticosteroid (44.4%); BCG, ear piercing, vaccination was Zn-Tape, corticosteroid & surgical excision (5.9%, 23.5%, 11.8%); trauma and spontaneous scars was Zn-Tape & surgery (22.2%, 11.1%). Scar size was mostly (2-5 cm) in different lines of therapy.

Treatment duration was significantly varies between studied groups (p<0.01) with longest duration in patients treated with Zn-Tape, corticosteroid & surgery and shortest with Zn-Tape & corticosteroid. Between studied groups, flattening degree was significantly differed (p<0.5).

Itching, pigmentation, erythema, scar size, pliability were mostly improved in patients treated with Zn-Tape (88.9%, 72.2%, 72.2%, 77.8%, 77.8%), Zn-Tape & corticosteroid (66.7%, 44.4%, 44.4%, 77.8%, 66.7%), Zn-Tape & surgery (55.6%, 88.9%, 77.8%, 100%, 66.7%), Zn-Tape, corticosteroid & surgery (64.7%, 70.6%, 58.8%, 100%, 64.7%). Flattening degrees were mostly significant flattening (75-90%) with Zn-Tape (55.6%), Zn-Tape & corticosteroid (55.6%), Zn-Tape & surgery (77.8%), Zn-Tape & surgery (35.3%). Complete flattening (100%) was obtained with Zn-Tape & surgery and with Zn-Tape, corticosteroid & surgery (22.2%, 29.0%). Degree of flattening was significantly found in Zn-Tape, corticosteroid & surgery compared to Zn-Tape and Zn-Tape & corticosteroid (p<0.05 for both) and in Zn-tape & surgery compared to Zn-Tape & corticosteroid (p<0.05) treated groups Table 4. (Figs. 1,2,3).

General improvement, patients satisfaction after treatment were mostly observed in all treated groups with significant difference between them (p<0.05). 100% improvement obtained with patients treated with Zn-tape & surgery and Zn-Tape, corticosteroid & surgery. Most of cases showed no recurrence, only three cases showed recurrence (2 cases on Zn-Tape & surgery and 1 case on Zn-tape, corticosteroid & surgery) with no significance difference between them (p>0.05). Non recurrence rate was significantly lower in Zn-Tape & surgery group compared to Zn-Tape and Zn-Tape & corticosteroid (p<0.05 for both) Table 5.

Table 1. Characteristics of all keloid patients.

Parameters	Values (n=53)	Significance
Age (mean±SD, range, years)	22.67±12.56 (3.00-53.00)	-
Nationality (number, %)		
Saudi	28 (52.8%)	
Non-Saudi	25 (47.2%)	p>0.05
Asian	20 (37.8%)	
African	5 (9.4%)	
Sex (number, %)		
Male / Female	15 (28.3%) / 38 (71.7%)	p<0.01
Skin color (number, %)		
White	16 (30.2%)	
Brown	33 (62.3%)	
Black	4 (7.5%)	p<0.000
Family history (number, %)		
No	47 (88.7%)	
Yes	6 (11.3%)	p<0.000
Duration of disease (mean±SD, range, years)	4.20±4.57 (0.50-21.00)	-
Diameter of scar (mean±SD, range, cm)	2.11±0.87 (1.00-4.00)	-
Line of therapy (number, %)		
One therapy	18 (34.0%)	
Two therapy	18 (34.0%)	
Three therapy	17 (32.1%)	p>0.05
Treatment (mean±SD, range, months)	13.38±6.48 (6.00-24.00)	-
Recurrence rate		
No	50 (94.3%)	
Yes	3 (5.7%)	p<0.000

Data are expressed as numbers (percentage to total).

Table 2. Characteristics of keloid patients according to type of therapy.

Variables	Therapy line				Significance
	Zinc oxide (n=18)	ZO & corticosteroid (n=9)	ZO & surgery (n=9)	ZO, corticosteroid & surgery (n=17)	
Age (mean±SD)	19.26±11.1	24.7±12.7	20.45±13.2	24.94±13.5	p>0.05
Nationality					
Saudi	10 (55.6%)	5 (55.6%)	5 (55.6%)	8 (47.1%)	p>0.05
Non-Saudi	8 (44.4%)	4 (44.4%)	4 (44.4%)	9 (52.9%)	
Sex					
Male	7 (38.9%)	3 (33.3%)	2 (22.2%)	3 (17.6%)	p>0.05
Female	11 (61.1%)	6 (66.7%)	7 (77.8%)	14 (82.4%)	
Skin color					
White	8 (44.4%)	2 (22.2%)	1 (11.1%)	5 (29.4%)	p>0.05
Brown	7 (38.9%)	7 (77.8%)	8 (88.9%)	11 (64.7%)	
Black	3 (16.7%)	-	-	1 (5.9%)	
Family history					
No	15 (83.3%)	9 (100%)	8 (88.9%)	15 (88.2%)	p>0.05
Yes	3 (16.7%)	-	1 (11.1%)	2 (11.8%)	

ZO: zinc oxide, data are expressed as number (percent to therapy group).

P significance between groups using one way ANOVA test.

Table 3. Scar characteristics according to type of therapy.

Variables	Therapy line				Significance Between groups
	1st line (Monotherapy)	2nd line (Ditherapy)	3rd line (Tritherapies)		
	Zn-Tape (n=18)	Zn-Tape & corticosteroid (n=9)	Zn-Tape & surgery (n=9)	Zn-Tape , corticosteroid & surgery (n=17)	
Location					
Ear	2 (9.5%)	1 (9.1%)	1 (11.1%)	5 (25.0%)	-
Face	2 (9.5%)	1 (9.1%)	1 (11.1%)	1 (5.0%)	
Neck	-	-	2 (22.2%)	-	
Arm	3 (14.3%)	1 (9.1%)	-	3 (15.0%)	
Deltoid	3 (14.3%)	1 (9.1%)	1 (11.1%)	3 (15.0%)	
Chest	5 (23.8%)	3 (27.3%)	2 (22.2%)	2 (10.0%)	
Trunk	1 (4.8%)	2 (18.2)	2 (22.2%)	4 (20.0%)	
Leg	4 (19.0%)	1 (9.1%)	-	1 (5.0%)	
Foot	1 (4.8%)	1 (9.1%)	-	1 (5.0%)	
Cause of scar					
Burn	6 (33.3%)	3 (33.3%)	3 (33.3%)	5 (29.4%)	
Infection	4 (22.2%)	-	-	-	
Trauma	3 (16.7%)	-	2 (22.2%)	1 (5.9%)	
Surgical incision	3 (16.7%)	4 (44.4%)	2 (22.2%)	3 (17.6%)	
BCG	-	-	-	1 (5.9%)	
Ear piercing	2 (11.1%)	1 (11.1%)	1 (11.1%)	4 (23.5%)	
Vaccination	-	1 (11.1%)	-	2 (11.8%)	
Spontaneous	-	-	1 (11.1%)	1 (5.9%)	
Size of scar					
≤ 1cm	3 (16.7%)	1 (11.1%)	1 (11.1%)	6 (35.3%)	p>0.05
2-5 cm	11 (61.1%)	6 (66.7%)	6 (66.7%)	8 (47.1%)	
6-9 cm	3 (16.7%)	1 (11.1%)	1 (11.1%)	-	
≥ 10 cm	1 (5.6%)	1 (11.1%)	1 (11.1%)	3 (17.6%)	

Zn-Tape: zinc oxide adhesive tape, data are expressed as number (percent to therapy group).

P significance between studied groups using one way ANOVA test.

Table 4. Improvement of symptoms and signs to different types of therapy.

Variables	Therapy line				Significance Between groups
	Zn-Tape (n=18)	Zn-Tape & corticosteroid (n=9)	Zn-Tape & surgery (n=9)	Zn-Tape, corticosteroid & surgery (n=17)	
Duration of therapy (months)					
(mean±SD)	10.56±4.69	10.22±5.87	15.00±5.61	17.18±6.97	
LSD Significance		1P>0.05	1P>0.05 2P>0.05	1P<0.01 2P<0.05	p<0.01
Itching					
No itching	-	1 (11.1%)	3 (33.3%)	4 (23.5%)	
Improved	16 (88.9%)	6 (66.7%)	5 (55.6%)	11 (64.7%)	
No change	2 (11.1%)	2 (22.2%)	1 (11.1%)	2 (11.8%)	
Increased	-	-	-	-	
LSD Significance					p>0.05
Pigmentation					
Normal color	2 (11.1%)	3 (33.3%)	1 (11.1%)	4 (23.4%)	
Reduced	13 (72.2%)	4 (44.4%)	8 (88.9%)	12 (70.6%)	
No changes	3 (16.7%)	2 (22.2%)	-	1 (5.9%)	
LSD Significance					p>0.05
Erythema					
No erythema	-	3 (33.3%)	1 (11.1%)	4 (23.5%)	
Improved	13 (72.2%)	4 (44.4%)	7 (77.8%)	10 (58.8%)	
No change	5 (27.8%)	2 (22.2%)	1 (11.1%)	3 (17.6%)	
Increased	-	-	-	-	
LSD Significance					p>0.05
Size					
Improved	14 (77.8%)	7 (77.8%)	9 (100%)	17 (100%)	
No change	4 (22.2%)	2 (22.2%)	-	-	
Increased	-	-	-	-	
LSD Significance				1P<0.05	p>0.05
Pliability					
Normal	3 (16.7%)	1 (11.1%)	2 (22.2%)	6 (35.3%)	
Soft	14 (77.8%)	6 (66.7%)	6 (66.7%)	11 (64.7%)	
Firm	1 (5.6%)	2 (22.2%)	1 (11.1%)	-	
LSD Significance				2P<0.05	p>0.05
Flattening					
<50%	2 (11.1%)	2 (22.2%)	-	-	
50-75%	2 (11.1%)	1 (11.1%)	-	1 (5.9%)	
75-90%	6 (55.6%)	5 (55.6%)	7 (77.8%)	6 (35.3%)	
>90%	2 (11.1%)	-	-	5 (29.4%)	
100%	2 (11.1%)	1 (11.1%)	2 (22.2%)	5 (29.4%)	
LSD Significance			2P<0.05	1P<0.05 2P<0.05	p<0.05

Zn-Tape: zinc oxide adhesive tape, data are expressed as number (percent to therapy group). P significance between groups; 1P significance versus zinc oxide treated group; 2P significance versus zinc oxide and corticosteroid treated group.

Table 5. End results of different types of therapy.

Variables	Therapy line				Significance Between groups
	Zn-Tape (n=18)	Zn-Tape & corticosteroid (n=9)	Zn-Tape & surgery (n=9)	Zn-Tape , corticosteroid & surgery (n=17)	
Improvement					
Yes	16 (88.6%)	7 (77.8%)	9 (100%)	17 (100%)	
No	2 (11.1%)	2 (22.2%)	-	-	
Significance	-	-	-	1P<0.05	p>0.05
Patient Satisfaction					
Unknown	3 (16.7%)	3 (33.3%)	1 (11.1%)	2 (11.8%)	
Yes	14 (77.8%)	6 (66.7%)	8 (88.9%)	15 (88.2%)	
No	1 (5.6%)	-	-	-	
Significance	-	-	-	-	p>0.05
Recurrence					
No	18 (100%)	9 (100%)	7 (77.8%)	16 (94.1%)	
Yes	-	-	2 (22.2%)	1 (5.9%)	
Significance	-	-	1P<0.05	-	p>0.05
	-	-	2P<0.05	-	

Zn-Tape: zinc oxide adhesive tape, data are expressed as number (percent to therapy group).

P significance between groups; 1P significance versus zinc oxide treated group; 2P significance versus zinc oxide and corticosteroid treated group.

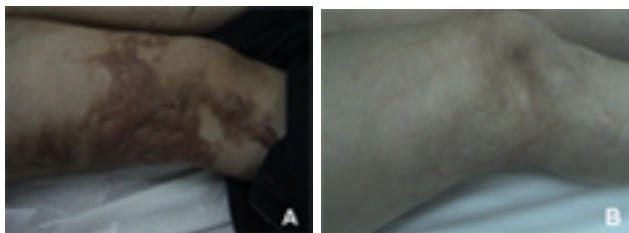


Fig 1. a. Lower limb post burn keloid in 9 years old female patient.
b. Flattening and reduced hyperpigmentation following 8 months treatment with zinc oxide tape.

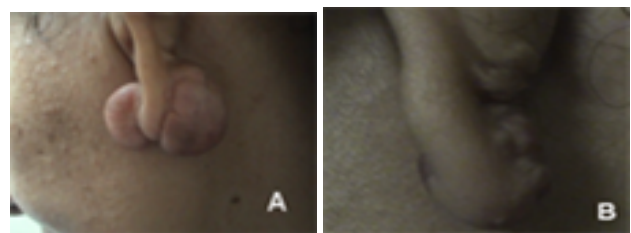


Fig 3. a. Ear lobule post ear piercing keloid in 48 years old women.
b. Highly significance flattening after 15 months following treatment with zinc oxide tape and intralesional injection of steroid and surgery.

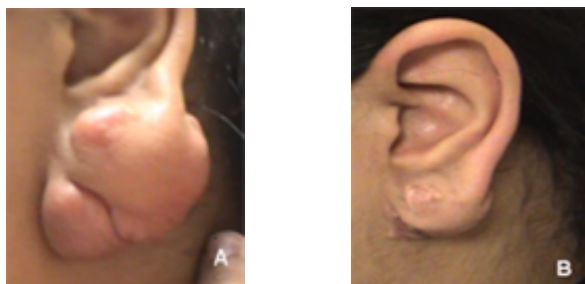


Fig 2. a. Ear lobule post ear piercing keloid in 20 years old women.
b. Highly significance flattening after 12 months following treatment with zinc oxide tape and intralesional injection of steroid.

DISCUSSION

Keloids are known to every surgeon but their etiology remains obscure and their treatment controversial. Black and Asian people are more likely to develop these lesions than Caucasian, incidence varying from 5:1 to 15:1.⁽²¹⁾ In this study, numbers of brown colored skin were significantly elevated compared to black and white patients, which could be explained by high incidence of brown compared to black population lived in this area. In this study, non-Saudi patients were 20 (37.8%) Asian and 5 (9.4%) African. Metabolism aberration of melanocyte-stimulating hormone has been suggested to be responsible for racial difference.^(21,22)

Zinc oxide adhesive tape were reported to have many advantages i.e. it is cheap, easily to apply and understood by both patients and parent, convenience as it reduces the number frequency of hospital attendances, non bulky and so did not interfere with organ functions, it is not traumatic to wound and painless to remove,⁽²³⁾ these advantages led author to study efficacy of usage of Zn-Tape as 1st line keloid therapy or in combination with corticosteroid or surgical excision when it remain unresponsive patient would receive the 3 modalities (Zn tape, corticosteroid and surgical excision) as 3rd line therapy.

Response of our patients to treatment was varies depending on anatomical site and scar size, patient propensity to form keloid as determined from personal or family history. Data from this study showed that Zn-Tape is excellent, simple treatment for early, small sized keloid especially those caused by burn and infection. It is also used as prophylactic measure in surgical wounds. In this study, usage of Zn-tape alone as 1st line therapy associated with reduction of erythema, itching, pliability and produced flattening. These marked improvement reach up to (88.6%), with (77.8%) patient's satisfaction.

Our findings were in consistence with others⁽¹⁸⁾ who reported that Zn-Tape is an effective treatment modality for keloid as it improved appearance, surface texture, scars color. Soderberg et al.⁽¹⁸⁾ claimed improvement to be dependant on size, duration, etiology of scars as well as age, sex of patients. However, mechanisms behind effect of Zn-Tape on keloid scar as not clear and yet different studies showed different actions by which zinc might interfere with metabolism of keloid in several ways. Some researchers^(24,25) claimed that Zn-Tape acted as an occlusive adhesive dressing lead to reduction of evaporation from keloid. Meanwhile, others⁽²⁶⁾ reported that zinc absorbed from Zn-Tape might play role in correction of the imbalance in synthesis and degradation of collagen which occurs in keloid. In vitro fibroblast synthesis of collagen is depressed by zinc sulphate.⁽²⁷⁾ Lysyl oxidase activity (enzyme responsible for collagen cross linking) was inhibited by ionized zinc.⁽²⁸⁾ Collagen degraded mainly by collagenase (zinc dependant enzyme) was inhibited by serum α -2 macroglobulin⁽²⁹⁾ which is zinc containing protein.⁽³⁰⁾

In this study, corticosteroid therapy or surgical excision in combination with Zn-tape were used as 2nd line of therapy to augment the outcome of Zn-Tape in complicated or unresponsiveness cases or in patients with increased susceptibility for recurrence.

General improvement of itching, pigmentation, erythema, size, pliability, flattening and satisfaction were observed with different forms of 2nd line of treatment. Improvement and satisfaction were with Zn-Tape & surgery (100%,

88.9%), with Zn-Tape & corticosteroid (77.8%, 667%) and in 3rd line with Zn-tape, corticosteroid & surgery was (100%, 88.2%).

In consistence with others usage of pre and postoperative intralesional corticosteroids was associated with symptomatic relief,^(31,32) regression of keloid,⁽³²⁾ general improvement, reduction of recurrence.^(26,22) Keloids treated with triamcinolone showed decreased levels of protease inhibitors α 2-macroglobulin and α 1-antitrypsin, suggesting their removal by corticosteroids.⁽³³⁾ Regiment of maintenance of postoperative corticosteroid treatment in this was consistence with others.⁽²²⁾ Some protocols recommended an intraoperative first dose followed by -6 weekly injections for 6-10 months.⁽²⁶⁾ In this study, no local complication of corticosteroid therapy such as skin atrophy, depigmentation, telangiectasis were reported as corticosteroid was given intralesionally and not into subcutaneous tissue as described before.⁽²¹⁾ Ketchum et al.⁽²¹⁾ reported that 95% of complications with corticosteroid injection result from incorrect drug use.

Surgery was used for lesions unresponsive to corticosteroids or pressure, or to debulk large lesions or cosmetic reasons in patients with face scar (including ear). In agreement with others,⁽³¹⁾ using intramarginal surgical excision of keloid, leaving a minimal edge of scars showed minimum stimulus of collagen synthesis with reduction of recurrence particularly if it is followed by application of Zn-Tape.

Duration of treatment is significantly varies between our studied groups with highest duration in-patient treated with Zn-Tape, corticosteroid & surgery; shortest in-patient treated with Zn-Tape & corticosteroid. This can be explained by more complex and difficulty scars needing longer duration with combination therapy to respond.

Most of our patients showed no recurrence. Only three female showed recurrence (5.7%); 2 cases in ear caused by ear piercing (1 case treated by Zn-Tape & surgery; other by Zn-Tape, surgery & corticosteroid) and 1 case on sternum caused by burn, treated by Zn-Tape, corticosteroid & surgery. It was noticed that recurrence occurs at time pregnancy or at puberty or at time when patient receive hormonal therapy for infertility treatment which suggesting important association of hormonal imbalance in recurrence.^(34,35,22) Various rate of keloid recurrence had been reported which reveals that recurrence rate depending on mode of treatment. Previously, it had been reported that surgical excision alone associated with high recurrent rate between 45% - 100%³ which decreased with use of adjuvant therapy such as intralesionally corticosteroid, interferon, imiquimod 5% cream, or post excision radiotherapy.⁽³⁶⁾ It had been reported that combination therapy is treatment of choice in

area that characterized by high recurrence rate like ear.⁽³⁶⁾

Pathogenesis of keloid scarring is only partly understood at present. Better understanding of keloids pathogenesis will help to plan more effective prevention and treatment of keloids with minimal complications. So, now prevention should be first rule of keloid therapy.

In conclusion, based on clinical improvement of keloid patients in this study, the author strongly recommended usage of zinc oxide adhesive tape as prophylactic and as first line of simple keloids therapy, because it is cheap and easily to apply and understood by both patients and parent, non bulky and so did not interfere with organ functions, in unresponsiveness cases 2nd line combined therapy with adjuvant corticosteroid or surgical excision is recommended.

REFERENCES

1. Boyadjiev C, Popchristova E, Mazgalova J. Histomorphologic changes in keloids treated with Kenacort. *J Trauma*. 1995;38:299-302.
2. Urioste SS, Arndt KA, Dover JS. Keloids, and hypertrophic scars: review and treatment strategies. *Semin Cutan Med Surg*. 1999;18:159-71.
3. Shaffer JJ, Taylor SC, Cook-Bolden F. Keloidal scars: a review with a critical look at therapeutic options. *J Am Acad Dermatol*. 2002;46:S63-S97.
4. Kiil J. Keloids treated with topical injections of triamcinolone acetonide (kenalog). Immediate and long-term results. *Scand J Plast Reconstr Surg*. 1977;11:169-72.
5. Fitzpatrick RE. Treatment of inflamed hypertrophic scars using intralesional 5-FU. *Dermatol Surg*. 1999;25:224-32.
6. Cosman B, Wolf M. Correlation Keloid recurrence of facial excision. *Plast Reconstr Surg*. 1972;27:335.
7. Rusciani L, Rossi G, Bono R. Use of cryotherapy in the treatment of keloids. *J Dermatol Surg Oncol*. 1993;19:529-34.
8. Kovalic JJ, Perez CA. Radiation therapy following keloidectomy: a 20-year experience. *Int J Radiat Oncol Biol Phys*. 1989;17:77-80.
9. Brent B. The role of pressure therapy in management of earlobe keloids: preliminary report of a controlled study. *Ann Plast Surg*. 1978;1:579-81.
10. Ahn ST, Monafu WW, Mustoe TA. Topical silicone gel: a new treatment for hypertrophic scars. *Surgery*. 1989;106:781-87.
11. Goldman MP, Fitzpatrick RE. Laser treatment of scars. *Dermatol Surg*. 1995;21:685-87.
12. Hallmans G. Absorption of topically applied zinc and changes in zinc metabolism during wound healing. An experimental and clinical investigation. *Acta Derm Venereol Suppl (Stockh)*. 1978;58:1-36.
13. Soderberg T, Nystrom A, Hallmans G, Hulten J. Treatment of fingertip amputations with bone exposure. A comparative study between surgical and conservative treatment methods. *Scand J Plast Reconstr Surg*. 1983;17:147-52.
14. Soderberg T, Hallmans G, Stenstrom S. Treatment of leprosy wounds with adhesive zinc tape. *Lepr Rev*. 1982;53:271-76.
15. Stromberg HE, Agren MS. Topical zinc oxide treatment improves arterial and venous leg ulcers. *Br J Dermatol*. 1984;111:461-8.
16. Mutalik S. Treatment of keloids and hypertrophic scars. *Indian J Dermatol Venereol Leprol*. 2005;71:3-8.
17. Soderberg T, Hallmans G, Bartholdson L. Treatment of keloid and hypertrophic scars with adhesive zinc tape. *Scand J Plast Reconstr Surg*. 1982;16:261-6.
18. Stenstrom S, Hallmans G, De Jongh A, De Wael T. Leprosy wound healing with ordinary adhesive tape. A preliminary report. *Scand J Plast Reconstr Surg*. 1976;10:241-4.
19. Sullivan T, Smith J, Kermode J, McIver E, Courtemanche DJ. Rating the burn scar. *J Burn Care Rehabil*. 1990;11:256-60.
20. Henderson DL. Discussin: the effect of carbon dioxide laser surgery on the recurrence of Keloid. *Plast Reconstr Surg*. 1991;1:50-3.
21. Ketchum LD, Cohen IK, Masters FW. Hypertrophic scars and keloids. A collective review. *Plast Reconstr Surg*. 1974;53:140-54.
22. Chowdri NA, Masarat M, Mattoo A, Darzi MA. Keloids and hypertrophic scars: results with intraoperative and serial postoperative corticosteroid injection therapy. *Aust N Z J Surg*. 1999;69:655-9.

23. Hughes G, McLean NR. Zinc oxide tape: a useful dressing for the recalcitrant finger-tip and soft-tissue injury. *Arch Emerg Med.* 1988;5:223-7.
24. Hallmans G. Zinc resorption from zinc-tape during wound healing. An experimental study in rats. *Scand J Plast Reconstr Surg.* 1977;11:27-32.
25. Wetter L, Agren MS, Hallmans G, Tengrup I, Rank F. Effects of zinc oxide in an occlusive, adhesive dressing on granulation tissue formation. *Acta Pharmacol Toxicol (Copenh).* 1986;59:184-7.
26. Cohen IK, McCoy BJ. The biology and control of surface overhealing. *World J Surg.* 1980;4:289-95.
27. Waters MD, Moore RD, Amato JJ, Houck JC. Zinc sulfate-failure as an accelerator of collagen biosynthesis and fibroblast proliferation. *Proc Soc Exp Biol Med.* 1971;138:373-7.
28. Chvapil M, Walsh D. A new method to control collagen cross-linking by inhibiting lysyl-oxidase with zinc. In Vogel HG, ed. *Connective tissue and ageing.* Excerpta Medicine Amsterdam. 1973;226.
29. Seltzer JL, Jeffrey JJ, Eisen AZ. Evidence for mammalian collagenases as zinc ion metalloenzymes. *Biochim Biophys Acta.* 1977;485:179-87.
30. Adham NF, Song MK, Rinderknecht H. Binding of zinc to alpha-2-macroglobulin and its role in enzyme binding activity. *Biochim Biophys Acta.* 1977;495:212-19.
31. Conway H, Stark RD. ACTH in treatment of keloids. *Plast Reconstr Surg.* 1951;8:354-7.
32. Hollander A. Intralesional injections of triamcinolone acetonide; a therapy for dermatoses. *Antibiotic Med Clin Ther.* 1961;8:78-83.
33. Rockwell BW, Cohen EK, Ehrlich HP. Keloids and hypertrophic scars: a comprehensive review. *Scand. J. Plast. Recon.* 1989;84:827-37.
34. George AO, Akanji AO, Nduka EU, Olasode JB, Odusan O. Clinical, biochemical and morphologic features of acne keloidalis in a black population. *Int. J. Dermatol.* 1993;32:714-16.
35. Schierle HP, Scholz D, Lemperle G. Elevated levels of testosterone receptors in keloid tissue: An experimental investigation. *Plast. Reconstr. Surg.* 1997;100:390-5.
36. Berman B, Flores F. Recurrence rates of excised keloid treated with post operative triamcinolone-acetonide injections or interferon alpha-2b injection. *J Am Acad Dermatol.* 1997;37:755-7.