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Oral collagen supplementation in 2nd degree burn and chronic pressure ulcers

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ORIGINAL STUDY

Oral collagen supplementation in second-degree burn and chronic pressure ulcers

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Abstract

Background: **Healing of wounds requires adequate intake of protein, iron, vitamin C, and zinc. In case of deficiency in the dietary intake, supplements may be prescribed. Collagen-peptide supplements can enhance skin hydration, elasticity, and reduce wrinkles. Burns, caused by various agents, severely damage skin layers. Pressure ulcers occur when prolonged pressure on the skin leads to tissue ischemia, disrupting nutrition and oxygen supply, resulting in tissue necrosis. Systematic reviews show that oral collagen, either intact or hydrolyzed, effectively improves skin health.**

Objectives: **This article evaluates the effect of oral collagen intake as a healing promoting supplementation in the management of second-degree burn and chronic pressure ulcers.**

Patients and methods: **This study was implemented on 80 patients from 15 to 50 years old, from Qalyubia and Cairo governorates including rural and urban areas. Patients will be divided into two groups; the first, group of burn patients, will be divided into two subgroups: (A) will receive oral collagen supplementation in addition to oral treatment and (B) will not receive oral collagen supplementation. The second group of chronic pressure ulcers will be divided into two subgroups: (A) will receive oral collagen supplementation added to oral treatment and (B) will not receive oral collagen supplementation.**

Results: **Regarding significant values, the socioeconomic status was much higher in group 1 (A) ($P = 0.001$) and in group 2 (A) ($P = 0.001$). Patient compliance was much higher in group 1 (A) ($P = 0.002$) and in group 2 (A) ($P = 0.001$). Burn degree, type of overlying dressing, frequency of dressing, size of wound, and depth of wound shows nonsignificant differences side effects of oral medication shows nonsignificant difference in group 1 and a significant difference in group 2 ($P = 0.019$). Rapid healing was recorded for group 1 (A) (8.30 ± 2.74 days) and in group 2 (A) (12.00 ± 1.34 days). Out of 80 patients 68 (or their relatives) were satisfied with the results and felt comfortable with oral supplementation intake.**

Conclusion: **Oral collagen supplementation had been found to accelerate wound healing and improves the outcome and patient satisfaction.**

Keywords: Chronic pressure ulcers, Healing promotor, Oral collagen, Second-degree burn

1. Introduction

1.1. Background

Burns are severe thermal injuries caused by various agents such as biological, chemical, electrical, and physical factors, leading to local and systemic consequences. They represent some of the most intense forms of trauma known to humanity, with treatment improving over time due to scientific advancements [1]. Based on their depth, burns are classified into first degree (affecting only the epidermis, like sunburns), superficial second degree (impacting both the epidermis and papillary dermis), deep second degree (extending to the reticular dermis), and third degree (damaging all three skin layers and possibly muscles) [2]. Pressure ulcers, another type of injury, occur when constant

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pressure on a skin area leads to tissue ischemia, loss of nutrition and oxygen, and ultimately tissue necrosis. They result from localized, acute ischemic damage due to external forces such as shear and compression, causing deformation or distortion [3].

Malnutrition is a key factor in the development and impaired healing of pressure ulcers [4–6]. Malnourished individuals lack the necessary nutrients for tissue maintenance and repair, leading to reduced fatty tissue padding, poorer skin condition with lowered resistance to shear and pressure, physical weakness, reduced activity, and edema [7]. Adequate nutrition, especially in protein, iron, vitamin C, and zinc, is crucial for wound healing, with supplements often prescribed for deficiencies [2].

Nutrition significantly affects skin physiology, with good nutritional status often reflecting healthy skin, seen as an indicator of overall well-being. Although many nutritional supplements claim to improve skin health and promote a youthful appearance, scientific evidence supporting these claims is often preliminary [8]. Nutrition and wound healing are closely linked with malnutrition, particularly undernutrition, negatively impacting body form, function, and clinical outcomes [9]. Collagen peptides, directly affecting fibroblasts, M2-like macrophages, and oral tolerance-related mechanisms, may have beneficial effects on skin health [10]. While few studies have specifically explored the dermatological effects of ingested collagen peptides, systematic reviews suggest that oral administration of intact or hydrolyzed collagen improves skin health. Studies consistently report positive outcomes from collagen supplementation [11].

Absorption data found the maximum concentration of peptides 1–2 h after oral ingestion of hydrolyzed collagen, with the concentration decreasing by half after 4 h [12,13]. In the dermis, hydrolyzed collagen has a dual-action mechanism, either providing amino acids for the synthesis of endogenous collagen and elastin fibers or stimulating the production of new collagen, elastin, and hyaluronic acid by bioactive peptides binding to fibroblast membrane receptors. These data can be explained by histological evidence [14]. Thus, consumption of oral hydrolyzed collagen supplement increases skin elasticity, hydration, and collagen density, improves wound healing, and protects the skin against aging [15] (Table 1).

Figs. 1–4 National Pressure Ulcer Advisory Panel Staging System of pressure ulcer [16].

2. Aim

The main objective of this work is assess the effectiveness of oral collagen as a supplement for promoting healing in the treatment of second-degree burns and chronic pressure ulcers.

Table 1. National Pressure Ulcer Advisory Panel staging system of pressure ulcer [16].

NPUAP staging system for pressure ulcers	
Stages	Description
Suspected deep-tissue injury	Purple or maroon localized area of discolored, intact skin, or blood-filled blister caused by damage to underlying soft tissue from pressure or shear; the discoloration may be preceded by tissue that is painful, firm, mushy, boggy, or warmer or cooler compared with adjacent tissue
I	Intact skin with nonblanchable redness of a localized area, usually over a bony prominence; dark pigmented skin may not have visible blanching, and the affected area may differ from the surrounding area; the affected tissue may be painful, firm, soft, or warmer or cooler compared with adjacent tissue
II	Partial-thickness loss of dermis appearing as a shallow, open ulcer with a red-pink wound bed, without slough; may also appear as an intact or open/ruptured serum-filled blister, this stage should not be used to describe skin tears, tape burns, perineal dermatitis, macerations, or excoriations
III	Full-thickness tissue loss; subcutaneous fat may be visible, but bone, tendon, or muscle is not exposed; slough may be present, but does not obscure the depth of tissue loss; may include undermining and tunneling[a]
IV	Full-thickness tissue loss with exposed bone, tendon, or muscle, slough or eschar may be present on some parts of the wound bed, often includes undermining and tunneling[a]
Unstageable	Full-thickness tissue loss with the base of the ulcer covered by slough (yellow, tan, gray, green, or brown) or eschar (tan, brown, or black) in the wound bed

NPUAP-National Pressure Ulcer Advisory Panel.

[a] The depth of a stage or IV pressure ulcer varies by anatomic location. Because the bridge of the nose, ear, occiput, and malleolus do not have subcutaneous tissue, ulcers on these areas can be shallow. In contrast, areas of significant adiposity can develop extremely deep stage II or IV ulcers. In stage IV ulcers, exposed bone or tendon is visible or directly palpable.

Adapted with permission from the National Pressure Ulcer Advisory Panel Updated staging system. http://www.puap.org/pr2.htm. Accessed December 17, 2007.

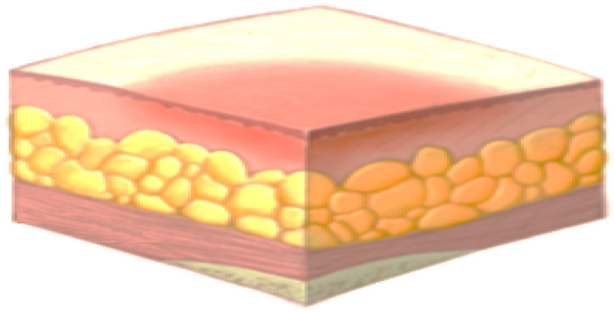

Fig. 1. Stage I pressure ulcer. Intact skin with nonblanching redness.

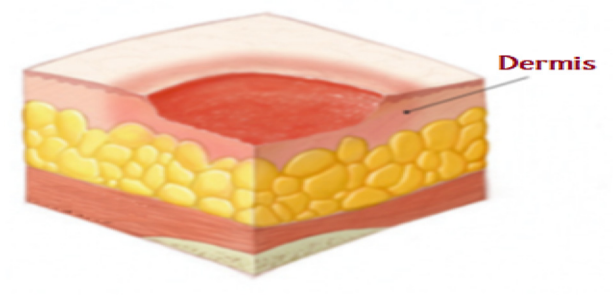

Fig. 2. Stage II pressure ulcer. Shallow open ulcer with red-pink wound bed.

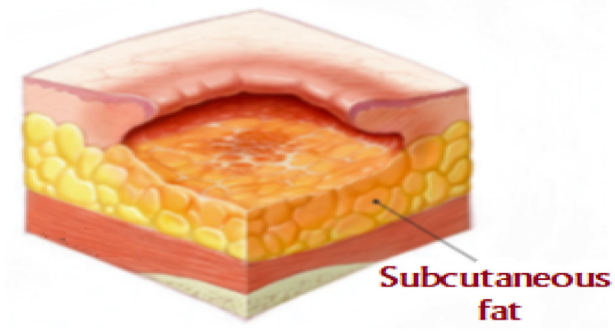

Fig. 3. Stage III pressure ulcer. Full-thickness tissue loss with visible subcutaneous fat.

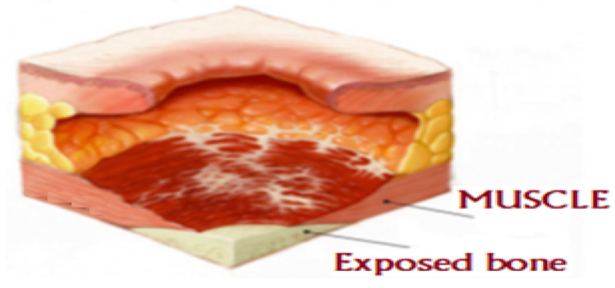

Fig. 4. Stage IV pressure ulcer. Full-thickness tissue loss with exposed muscle and bone.

3. Patients and methods

This study recruited 80 patients aged from 15 to 50 years from both rural and urban areas within the Qalyubia and Cairo governorates.

3.1. Ethical considerations

Earlier participation in the study; written informed consent was obtained from the parents or relatives of all participants.

3.2. Inclusion criteria

Participants aged between 15 and 50 years.

(1) Patients with second-degree burns covering less than 15 % of the total body surface area (TBSA).
(2) Patients with stages II and I pressure ulcers, as classified by the National Pressure Ulcer Advisory Panel (NPUAP) Staging System. The NPUAP Staging System categorizes pressure ulcers into several stages based on severity: suspected deep-tissue injury shows as discolored but intact skin, stage I as non-blanchable redness, stage II as partial-thickness skin loss, stage III as full-thickness skin loss without exposed muscle or bone, stage IV with exposed bone, tendon, or muscle, and unstageable where the wound bed is obscured by slough or eschar. This system helps clinicians determine the appropriate care for pressure ulcers, with staging varying by location and individual patient anatomy [12].

3.3. Exclusion criteria

(1) Patients with chronic diseases such as diabetes, hypertension, or heart disease.
(2) Patients with syndromes affecting skin condition or collagen synthesis.
(3) Patients with full-thickness burns or burns covering more than 15 % TBSA.
(4) Patients with neurological conditions that impair ambulation.

3.4. Methodology

Participants were stratified into two equal primary groups:

Group 1 − 40 burn patients: further divided into two even subgroups; subgroup A 20 patients will receive oral collagen supplementation in the form of marine collagen (Valigen) with a dosage of one

10 g sachet of pure marine collagen plus 500 mg vitamin C per day, in addition to standard oral treatment. Subgroup B will receive standard oral treatment without collagen supplementation.
Group 2 − 40 chronic pressure ulcer patients: also divided into two even subgroups with the same supplementation protocol as group 1. Subgroup A 20 patients will receive oral collagen supplementation in the form of marine collagen (Valigen), with a dosage of one 10 g sachet of pure marine collagen plus 500 mg vitamin C per day, in addition to standard oral treatment. Subgroup B will receive standard oral treatment without collagen supplementation.

Assessment procedures: participants will undergo a comprehensive assessment that includes:

(1) Collection of full personal data, including dietary habits and socioeconomic status.
(2) Detailed medical history, with emphasis on long-term treatments and any chronic illnesses.
(3) A complete set of investigations including erythrocyte sedimentation rate, C-reactive protein, random blood sugar, and complete blood count.
(4) Thorough medical examination to evaluate skin condition and check for any congenital anomalies.
(5) Standard daily dressing for all participants with normal saline and vaslinized gauze with daily supervision of the researchers and photo collection for all participants.

4. Results

4.1. Demographic data

The demographic characteristics were largely similar between the two groups in both the burn (1A and 1B) and pressure ulcer (2A and 2B) cohorts. No significant differences were found in mean age or sex distribution between the groups. As regards socioeconomic status, significant difference was observed between study groups ($P = 0.001$) (Table 2).

4.2. Patient compliance

Analysis of patient compliance shows that compliance was significantly higher in the collagen supplementation groups compared with placebo controls in both the burn ($P = 0.002$) and ulcer ($P = 0.001$) groups. Fig. 5 and Table 3 shows that in the burn cohort (groups 1A and 1B), there was a significant difference in patient compliance between the oral collagen supplementation and control groups ($P = 0.002$). The collagen group had a greater proportion rated as having good compliance (65 %) compared with the control group (20 %). Also, 35 % of the collagen group but 0 % of controls had poor compliance. Similarly, in the pressure ulcer cohort (groups 2A and 2B), good compliance was seen in 50 % of the collagen group but only 10 % of controls ($P = 0.001$). None of the patients receiving collagen showed poor compliance but 40 % of controls did.

4.3. Burn degree and burn percentage in burn patient groups

There were no significant differences in burn injury severity characteristics between the oral collagen supplementation (group 1A) and placebo control (group 1B) groups as shown in Table 5. The majority of patients in both groups had second degree burns (70 % of group 1A vs. 75 % of group 1B), with the remainder having third degree burns. The difference in burn degree distribution between groups was not statistically significant by the χ^2 test ($P = 0.723$). Moreover, the mean percent TBSA burned was 21.10 % in group 1A compared with

Table 2. Demographic data in burn and chronic pressure ulcer management.

Variables	Group 1A	Group 1B	Significant test	*P* value	Group 2A	Group 2B	Significant test	*P* value
Age			*t*-test = 0.159	0.875			*t*-test = 1.02	0.314
Range	17−46	18−50			29−50	32−50		
Mean ± SD	30.15 ± 9.17	30.65 ± 10.68			41.00 ± 6.61	42.95 ± 5.42		
Sex			$\chi^2 = 0.0$	1.0			$\chi^2 = 0.0$	1.0
Male	10 (50.0)	10 (50.0)			10 (50.0)	10 (50.0)		
Female	10 (50.0)	10 (50.0)			10 (50.0)	10 (50.0)		
Socioeconomic state			$\chi^2 = 27.077$	0.001[a]			$\chi^2 = 24.250$	0.001[a]
High	13 (65.0)	0			13 (65.0)	0		
Moderate	7 (35.0)	6 (30.0)			7 (35.0)	9 (45.0)		
Low	0	14 (70.0)			0	11 (55.0)		

Data represented as mean ± SD, range, or *n* (%).
P value for comparing between the two studied groups.
[a] Statistically significant at *P* value less than or equal to 0.05.

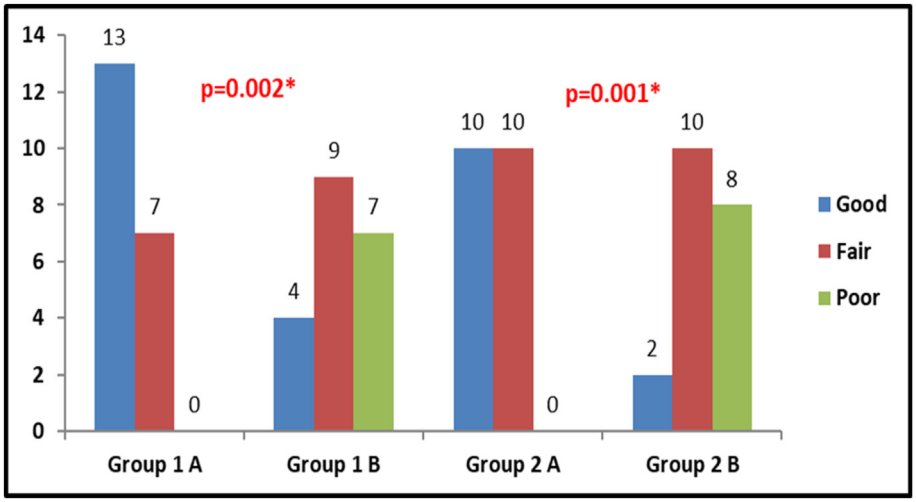

Fig. 5. Patient compliance in burn and chronic pressure ulcer management.

Table 3. Patient compliance in the study groups.

	Group 1A [*n* (%)]	Group 1B [*n* (%)]	χ^2	*P* value
Patient compliance				
Good	13 (65.0)	4 (20.0)	12.015	0.002*
Fair	7 (35.0)	9 (45.0)		
Poor	0	7 (35.0)		
	Group 2A	Group 2B	χ^2	*P* value
Good	10 (50.0)	2 (10.0)	13.333	0.001*
Fair	10 (50.0)	10 (50.0)		
Poor	0	8 (40.0)		

21.35 % in group 1B. There was no significant difference in mean TBSA by *t*-test ($P = 0.886$) (Table 4).

4.4. Size of wound and depth of chronic pressure ulcer

Results are presented in Table 5. There were no significant baseline differences found between the oral collagen (group 2A) and placebo control (group 2B) groups for parameters indicating chronic pressure ulcer severity. The mean wound size was 8.85 cm^2 in the collagen group compared with 10.10 cm^2 in controls. The depth was similar with collagen at 11.70 cm versus 12.05 cm for control. Neither wound size ($P = 0.211$) nor depth ($P = 0.793$) differed to a statistically significant degree between groups.

Table 4. Burn degree and percent of burn percentage in burn patient groups.

Variables	Group 1A	Group 1B	Significant test	*P* value
Burn degree			$\chi^2 = 0.125$	0.723
2nd degree	14 (70.0)	15 (75.0)		
3rd degree	6 (30.0)	5 (25.0)		
Percent of burn			*t*-test = 0.144	0.886
Range	10–30	10–29		
Mean ± SD	21.10 ± 5.93	21.35 ± 5.00		

Data represented as *n* (%).
P value for comparing between the two studied groups.
[a]Statistically significant at P value less than or equal to 0.05.

4.5. Comparative evaluation of treatment methods and healing times

These findings are demonstrated in Table 6. There were no significant differences found between the collagen supplementation and control groups in either the burn or the ulcer cohorts for dressing types and change frequencies used during the treatment period. Both groups received comparable standard wound care. However, major differences were observed in healing times. In the burn cohort, the mean time for wound healing was 8.3 days in the collagen group compared with 12.9 days in the control group ($P = 0.001$). Similarly for ulcers, the collagen group healed on average in 12 days versus 14.55 days for control ($P = 0.001$).

4.6. Side effects of oral medication

In the burn groups, a small proportion of patients in the collagen supplementation group (group 1A) reported side effects including nonpalatability (10 %), nausea (5 %), and gastric upset (15 %), while no side effects were seen in the control group (group 1B). However, the differences did not reach statistical significance by the χ^2 test ($P > 0.05$). In the pressure ulcer groups, significantly more collagen patients reported the oral preparation being nonpalatable (15 vs. 0 % of controls, $P = 0.019$). Gastric

Table 5. Size of wound and depth of wound in chronic pressure ulcer groups.

Variables	Group 2A	Group 2B	*t*-test	*P* value
Size of wound (cm^2)			*t*-test = 1.273	0.211
Range	4–15	5–15		
Mean ± SD	8.85 ± 2.87	10.10 ± 3.32		
Depth of wound (cm)			*t*-test = 0.264	0.793
Range	6–20	6–20		
Mean ± SD	11.70 ± 4.40	12.05 ± 3.97		

Data represent as mean ± SD and range.
P value for comparing between the two studied groups.
[a]Statistically significant at *P* value less than or equal to 0.05.

Table 6. Comparative evaluation of treatment methods and healing times in burn and chronic pressure ulcer management.

Variables	Group 1A	Group 1B	Significant test	*P* value	Group 2A	Group 2B	Significant test	*P* value
Type of overlying dressing			$\chi^2 = 0.0$	1.0			$\chi^2 = 0.0$	1.0
Healing promotor, ointment, and vaslinized gauze	10 (50.0)	10 (50.0)			10 (50.0)	10 (50.0)		
Ointment and vaslinized gauze	10 (50.0)	10 (50.0)			10 (50.0)	10 (50.0)		
Frequency of dressing			$\chi^2 = 1.026$	0.311			$\chi^2 = 1.667$	0.197
Daily	12 (60.0)	15 (75.0)			10 (50.0)	14 (70.0)		
Day after day	8 (40.0)	5 (25.0)			10 (50.0)	6 (30.0)		
Time of healing (days/weeks)			*t*-test = 6.647	0.001[a]			*t*-test = 5.525	0.001[a]
Range	1–11	10–16			10–15	12–18		
Mean ± SD	8.30 ± 2.74	12.90 ± 1.45			12.00 ± 1.34	14.55 ± 1.57		

Data represented as *n* (%).
P value for comparing between the two studied groups.
[a] Statistically significant at *P* value less than or equal to 0.05.

side effects were only reported in the collagen group (20 %). Still, the majority of both cohorts had no side effects − 60 and 65 % of collagen patients for burns and ulcers, respectively (Table 7).

4.7. Posthealing complication and patient satisfaction

Results illustrated in Table 8 shows that in the burn cohort, the oral collagen group 1A showed a tendency toward lower rates of posthealing complications such as contractures and hypertrophic scarring compared with placebo controls (1B) 20 versus 45 %, respectively. However, the difference did not reach statistical significance ($P = 0.091$). In contrast, in the pressure ulcer group, complication rates were identical at 55 % in both the collagen (2A) and control (2B) arms after ulcer closure. Patient satisfaction showed a trend similar to complications. A greater proportion of collagen burn patients were

Table 7. Side effects of oral medication in burn and chronic pressure ulcer management.

	Group 1A [*n* (%)]	Group 1B [*n* (%)]	χ^2	*P* value		Group 2A [*n* (%)]	Group 2B [*n* (%)]	χ^2	*P* value
Side effects of oral medication									
Nonpalatable	2 (10.0)	0	8.485	0.075	Nonpalatable	3 (15.0)	0	1.001	0.019*
Nausea	1 (5.0)	0			Gastric upset	4 (20.0)	0		
Gastric upset	3 (15.0)	0			Others	1 (5.0)	0		
Others	1 (5.0)	0			No	12 (60.0)	20 (100.0)		
No	13 (65.0)	20 (100.0)							

Table 8. Posthealing complication and patient satisfaction in burn and chronic pressure ulcer management.

Variables	Group 1A	Group 1B	χ^2	*P* value	Group 2A	Group 2B	χ^2	*P* value
Posthealing complication			2.849	0.091			0.0	1.0
Yes	4 (20.0)	9 (45.0)			11 (55.0)	11 (55.0)		
No	16 (80.0)	11 (55.0)			9 (45.0)	9 (45.0)		
Patient satisfaction			1.727	0.422			2.667	0.264
Satisfied	13 (65.0)	9 (45.0)			15 (75.0)	10 (50.0)		
Fair	5 (25.0)	7 (35.0)			3 (15.0)	6 (30.0)		
Not satisfied	2 (10.0)	4 (20.0)			2 (10.0)	4 (20.0)		

satisfied with healing outcomes (65 %) versus placebo patients (45 %). For ulcers, satisfaction rates were 75 and 50 % for collagen and control groups, though not significantly different (Figs 6–19).

Fig. 6. Chronic pressure ulcer in group 2A.

Fig. 7. After 2 weeks of dressing with oral supplementation.

Fig. 8. After 6 weeks of dressing.

Fig. 9. After 10 weeks of dressing.

Fig. 10. Second-degree burn in group 1A.

Fig. 11. After 5 days.

Fig. 12. After 8 days.

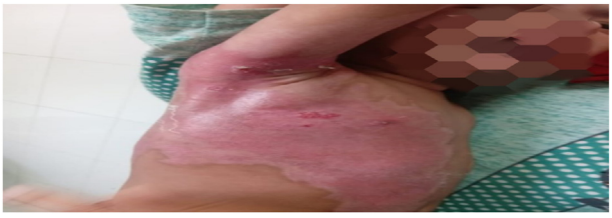

Fig. 13. After 10 days.

Fig. 14. Second-degree burn in group 1A.

Fig. 15. After 7 days.

Fig. 16. After 10 days.

Fig. 17. Second-degree burn in group 1A.

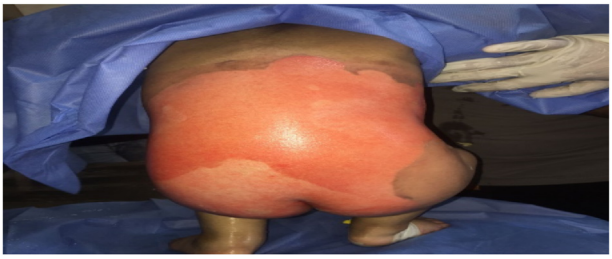

Fig. 18. After 5 days.

5. Discussion

This study investigates the impact of oral collagen supplementation in treating second-degree burns and chronic pressure ulcers, conditions that significantly affect patient quality of life. Chronic wounds, including pressure and diabetic foot ulcers, often result from prolonged pressure or poor circulation

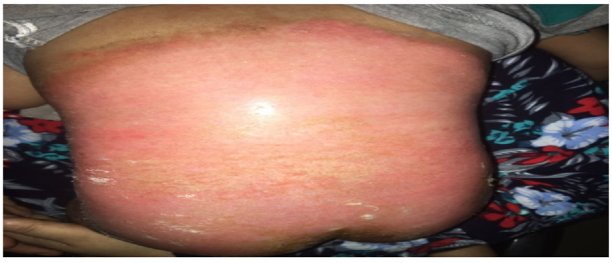

Fig. 19. After 7 days.

and are characterized by an overactive inflammatory response and altered extracellular matrix components [10]. Traditional wound therapies, evolving from ancient methods using honey and silk to modern polymer dressings, have limitations. Moist environments, beneficial for cell growth and wound healing, have led to the use of collagen hydrogels as effective dressings [10]. Collagen, sourced from animals or fish like *Nile tilapia*, is used in advanced wound therapies for drug delivery and skin regeneration [17]. This research focuses on the potential of oral collagen to enhance healing in specific burn and ulcer cases.

This study was implemented on about 80 patients from 15 to 50 years old from Qalyubia and Cairo governorates, including rural and urban areas. Patients were divided into two groups. The first group of burn patients were divided into two subgroups: (A) received oral collagen supplementation added to oral treatment and (B) did not receive oral collagen supplementation. The second group of chronic pressure ulcers were divided into two subgroups: (A) received oral collagen supplementation added to oral treatment and (B) did not receive oral collagen supplementation.

The mean age for group 1A (mean ± SD) was 30.15 ± 9.17 days, while it was 30.65 ± 10.68 days for group 1B ($P = 0.875$) and was 41.00 ± 6.61 days for group 2A with 42.95 ± 5.42 days for group 2B ($P = 0.314$) with nonsignificant difference between groups. In our study, as regards socioeconomic status significant difference was observed between study groups and patient compliance and patient satisfaction. Similarly, group 1A had a faster mean time to healing of 8.30 days compared with 12.90 days for group 1B. This difference was statistically significant based on the reported *t*-test ($P = 0.001$). Similarly, group 2A had a shorter mean time to healing of 12.00 weeks compared with14.55 for group 2B, which was also a statistically significant difference ($P = 0.001$). Overall, the data demonstrates that subgroups A in both group 1 and group 2 experienced significantly faster healing times than subgroups B.

Recent research has highlighted the positive impact of collagen supplementation on wound healing. A study by Miyab *et al*. [18] found that a hydrolyzed collagen-based supplement significantly increased the wound healing rate, providing almost total dietary energy and protein requirements for patients. Felician *et al*. [19] showed that collagen peptides derived from the jellyfish *Rhopilema esculentum* accelerated the wound healing process, indicating their potential future use in wound clinics.

Zhang *et al*. [20] demonstrated that oral administration of collagen peptides from Chum salmon skin improved wound healing in rat models. Similarly, Wang *et al*. [21] observed positive effects from the oral application of specific bioactive collagen peptides. Knefeli and Durani [22] reported better outcomes in patients treated with bioactive collagen peptides compared with placebo groups. Sato *et al*. [23] identified a collagen-derived peptide, prolyl-hydroxyproline (Pro-Hyp), as a growth-initiating factor for specific fibroblasts in wound healing.

Moreover, Peng *et al*. [24] found that daily supplementation with 0.5 g/kg glutamine for 14 days improved prealbumin levels, accelerated wound healing, and reduced hospital stays in patients with 30–75 % TBSA burns.

Collagen-based dressings have proven effective in healing diabetic foot ulcers and burns, as demonstrated in studies by Holmes *et al*. [25] and Ramakrishnan *et al*. [26]. These dressings work by modifying bacterial burden, supporting growth factors, reducing matrix metalloproteinases, and promoting cell proliferation and tissue synthesis [27]. Furthermore, administering 15 g of hydrolyzed collagen protein twice daily for 8 weeks improved pressure ulcer healing in long-term care residents [28].

Experimental studies, including those by Zhang *et al*. [20] and Zague *et al*. [29], have shown that hydrolyzed collagen enhances wound repair in diabetic ulcers by increasing capillary density and reducing inflammation. Beyond wound healing, oral collagen has been effective in reducing inflammation and protecting against ultraviolet-induced skin damage, by regulating procollagen production and reducing oxidative stress [30–32].

Recent studies have been increasingly demonstrating the impacts of taking collagen-peptide supplements on skin health. Nomoto and Iizaka [33] conducted research on adults found significant improvements in skin hydration and elasticity after an 8-week period of collagen supplementation. Similarly Bolke *et al*. [34] carried out a placebo-controlled study involving 72 women aged over 35 years, which revealed enhancements in skin parameters such as hydration and elasticity after consuming a collagen-based drink for 12 weeks.

In another study by Kim *et al*. [35], a randomized trial conducted under conditions with placebos showed that low molecular weight collagen-peptide significantly improved skin hydration and elasticity within a range of 6–12 weeks without any reported negative effects. Moreover, Asserin *et al*. [36] observed that oral collagen-peptide supplementation resulted in an increase in skin hydration, denser collagen levels in the dermis, and reduced collagen fragmentation is an indication of its anti-aging properties.

In the current study, regarding the side effects of oral medication between two groups, group 1B and group 2B had no reported side effects from the medication, while group 1A and group 2A reported some side effects like nonpalatability, nausea, gastric upset, and others, albeit at low frequencies. The differences in proportions of specific side effects between groups 1A and 1B and between groups 2A and 2B were statistically different. While most comparisons did not reach statistical significance, the difference in nonpalatability side effect between groups 2A (15 %) and 2B (0 %) was significant with a P value of 0.019. This suggests that the oral medication was significantly less palatable in group 2A compared with 2B. Similarly, comparison between four groups showed that statistically nonsignificant difference was observed between groups throughout the study period as regards posthealing complications.

While generally well-tolerated, collagen supplements do carry risks of hypersensitivity and allergic reactions in certain patients. People with shellfish allergies may react to marine-derived collagens. Furthermore, the type I collagen prevalent in bovine and fish products has caused anaphylaxis in people sensitive to components used in vaccines [37,38].

There are also two documented cases of women having generalized allergic reactions to collagen used therapeutically for tissue augmentation [39].

Moreover, animal-sourced collagen has inherent risks of disease transmission to humans. Porcine and bovine collagen may transmit illnesses through cross-species contact. Oral bovine collagen supplements could theoretically transmit prion diseases like BSE to people, although the risk is still under investigation [40]. Similarly, bovine graft materials used in dental clinics do pose some prion transmission risk if suboptimal sterilization occurs [41].

In conclusion, this study demonstrated that oral collagen supplementation significantly improved healing outcomes in both second-degree burn patients and those with chronic pressure ulcers.

Patients receiving collagen supplementation (groups 1A and 2A) showed markedly shorter healing times of 8.30 days and 12.00 weeks, respectively, compared with 12.90 days and 14.55 weeks in the nonsupplemented groups (1B and 2B) ($P = 0.001$ for both comparisons). Despite some minor side effects like nonpalatability, nausea and gastric upset occurring slightly more frequently in collagen-supplemented groups, overall complication rates posthealing did not differ significantly among groups. Given the considerable reductions in time to heal open wounds, oral collagen peptides taken in conjunction with standard treatment may provide substantial benefit for wound healing across different etiologies of tissue injury. Further studies could further define optimal dosing to limit tolerability issues while retaining faster healing times.

5.1. Conclusion

We conclude that adding oral collagen, which is easy to administer, palatable, and has minimal side effects, to the protocol of treatment for burn patients and chronic ulcers can improve the healing process and shortens the time needed for healing.

5.2. Recommendations

We recommend adding oral collagen to the treatment protocol for burn patients and those with chronic ulcers. Also, we recommend more investigation including histological examination to study the histological changes that occur in the healed skin.

Ethics information

No conflict of interest.

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Conflict of interest

Study conception and design: Dr/ WesamHomouda. Acquisition of data: Dr/ HelmyAhmedSoliman. Analysis and interpretation of data: Prof.Dr/ SayedElmokadem. Drafting of a manuscript: Dr/ WesamHomouda. Critical revision: Prof.Dr/ SayedElmokadem.

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