

World Journal of *Clinical Cases*

World J Clin Cases 2023 November 26; 11(33): 7940-8093



Contents

Thrice Monthly Volume 11 Number 33 November 26, 2023

EDITORIAL

- 7940 Glimpse into the future of prosthodontics: The synergy of artificial intelligence
Heboyang A, Yazdanie N, Ahmed N

MINIREVIEWS

- 7943 Application progress of nursing intervention in cardiac surgery
Wang SR, Zhou K, Zhang W

ORIGINAL ARTICLE

Retrospective Cohort Study

- 7951 Comparison between multiple logistic regression and machine learning methods in prediction of abnormal thallium scans in type 2 diabetes
Yang CC, Peng CH, Huang LY, Chen FY, Kuo CH, Wu CZ, Hsia TL, Lin CY

Retrospective Study

- 7965 Fever glove hand-shake method safe blood collection from children's fingertips in COVID-19 fever clinic
Luo L, Qin WL, Huang HM, Ou ZH, Peng ZH
- 7972 Influence of ganglioside combined with methylprednisolone sodium succinate on efficacy and neurological function in patients with acute myelitis
Sun YF, Liu LL, Jiang SS, Zhang XJ, Liu FJ, Zhang WM
- 7980 Treatment of postpartum depression with integrated traditional Chinese and Western medicine nursing and electrical stimulation
Zhai WH, Wang MJ, Zhao YJ, Hu SL, Zhou JM
- 7987 Prolonged impacts of COVID-19-associated cystitis: A study on long-term consequences
Wittenberg S, Vercnocke J, Chancellor M, Dhar S, Liaw A, Lucas S, Dhar N
- 7994 Comparative analysis of conventional ultrasound and shear wave elastography features in primary breast diffuse large B-cell lymphoma
Zhang XD, Zhang K
- 8003 Artificial dermis combined with skin grafting for the treatment of hand skin and soft tissue defects and exposure of bone and tendon
Wang W, Chen DS, Guo ZD, Yu D, Cao Q, Zhu XW
- Observational Study
- 8013 Subcutaneous fat thickness and abdominal depth are risk factors for surgical site infection after gastric cancer surgery
Yu KY, Kuang RK, Wu PP, Qiang GH

CASE REPORT

- 8022** Pathological diagnosis and immunohistochemical analysis of minute pulmonary meningotheelial-like nodules: A case report
Ruan X, Wu LS, Fan ZY, Liu Q, Yan J, Li XQ
- 8030** Giant complex hepatic cyst causing pseudocystitis: A case report
Li S, Tang J, Ni DS, Xia AD, Chen GL
- 8038** Carotid-subclavian bypass and endovascular aortic repair of Kommerell's diverticulum with aberrant left subclavian artery: A case report
Akili W, Feng Y, Zhang XX, Li SL, Ma XT, Hu M, Cheng C
- 8044** Granular cell tumor of the breast: A case report and review of literature
Yan J
- 8050** Fibula allograft transplantation combined with locking plate for treatment of recurrent monostotic fibular fibrous dysplasia: A case report
Xie LL, Yuan X, Zhu HX, Fu L, Pu D
- 8058** Asian variant intravascular large B-cell lymphoma with highly suspected central nervous system involvement: A case report
Lee YP, Son SM, Kwon J
- 8065** Treatment of adult congenital anal atresia with rectovestibular fistula: A rare case report
Wang J, Zhang XY, Chen JH, Jin HY
- 8071** Cerebral proliferative angiopathy in pediatric age presenting as neurological disorders: A case report
Luo FR, Zhou Y, Wang Z, Liu QY
- 8078** Hepatocellular carcinoma presenting as organized liver abscess: A case report
Ryou SH, Shin HD, Kim SB
- 8084** Generalized granuloma annulare in an infant clinically manifested as papules and atrophic macules: A case report
Zhang DY, Zhang L, Yang QY, Li J, Jiang HC, Xie YC, Shu H
- 8089** Successful leadless pacemaker implantation in a patient with dextroversion of the heart: A case report
Li N, Wang HX, Sun YH, Shu Y

ABOUT COVER

Editorial Board Member of *World Journal of Clinical Cases*, Vicky Panduro-Correa, DSc, FACS, MD, MSc, Professor, Surgeon, Department of Surgery, Hospital Regional Hermilio Valdizán, Huanuco 10000, Peru.
vpanduro@unheval.edu.pe

AIMS AND SCOPE

The primary aim of *World Journal of Clinical Cases* (WJCC, *World J Clin Cases*) is to provide scholars and readers from various fields of clinical medicine with a platform to publish high-quality clinical research articles and communicate their research findings online.

WJCC mainly publishes articles reporting research results and findings obtained in the field of clinical medicine and covering a wide range of topics, including case control studies, retrospective cohort studies, retrospective studies, clinical trials studies, observational studies, prospective studies, randomized controlled trials, randomized clinical trials, systematic reviews, meta-analysis, and case reports.

INDEXING/ABSTRACTING

The WJCC is now abstracted and indexed in Science Citation Index Expanded (SCIE, also known as SciSearch®), Journal Citation Reports/Science Edition, Current Contents®/Clinical Medicine, PubMed, PubMed Central, Reference Citation Analysis, China National Knowledge Infrastructure, China Science and Technology Journal Database, and Superstar Journals Database. The 2023 Edition of Journal Citation Reports® cites the 2022 impact factor (IF) for WJCC as 1.1; IF without journal self cites: 1.1; 5-year IF: 1.3; Journal Citation Indicator: 0.26; Ranking: 133 among 167 journals in medicine, general and internal; and Quartile category: Q4.

RESPONSIBLE EDITORS FOR THIS ISSUE

Production Editor: Zi-Hang Xu, Production Department Director: Xiang Li, Editorial Office Director: Jin-Lai Wang.

NAME OF JOURNAL

World Journal of Clinical Cases

ISSN

ISSN 2307-8960 (online)

LAUNCH DATE

April 16, 2013

FREQUENCY

Thrice Monthly

EDITORS-IN-CHIEF

Bao-Gan Peng, Salim Surani, Jerzy Tadeusz Chudek, George Kontogeorgos, Maurizio Serati

EDITORIAL BOARD MEMBERS

<https://www.wjgnet.com/2307-8960/editorialboard.htm>

PUBLICATION DATE

November 26, 2023

COPYRIGHT

© 2023 Baishideng Publishing Group Inc

INSTRUCTIONS TO AUTHORS

<https://www.wjgnet.com/bpg/gerinfo/204>

GUIDELINES FOR ETHICS DOCUMENTS

<https://www.wjgnet.com/bpg/GerInfo/287>

GUIDELINES FOR NON-NATIVE SPEAKERS OF ENGLISH

<https://www.wjgnet.com/bpg/gerinfo/240>

PUBLICATION ETHICS

<https://www.wjgnet.com/bpg/GerInfo/288>

PUBLICATION MISCONDUCT

<https://www.wjgnet.com/bpg/gerinfo/208>

ARTICLE PROCESSING CHARGE

<https://www.wjgnet.com/bpg/gerinfo/242>

STEPS FOR SUBMITTING MANUSCRIPTS

<https://www.wjgnet.com/bpg/GerInfo/239>

ONLINE SUBMISSION

<https://www.f6publishing.com>



Retrospective Study

Artificial dermis combined with skin grafting for the treatment of hand skin and soft tissue defects and exposure of bone and tendon

Wei Wang, Dong-Sheng Chen, Zhao-Di Guo, Dan Yu, Qin Cao, Xiao-Wei Zhu

Specialty type: Surgery

Provenance and peer review:

Unsolicited article; Externally peer reviewed.

Peer-review model: Single blind

Peer-review report's scientific quality classification

Grade A (Excellent): 0
Grade B (Very good): 0
Grade C (Good): 0
Grade D (Fair): 0
Grade E (Poor): 0

P-Reviewer: Grabiec AM, Poland

Received: September 25, 2023

Peer-review started: September 25, 2023

First decision: October 17, 2023

Revised: October 25, 2023

Accepted: October 30, 2023

Article in press: October 30, 2023

Published online: November 26, 2023



Wei Wang, Dong-Sheng Chen, Dan Yu, Xiao-Wei Zhu, Department of Operating Room, The First People Hospital of Jiangxia District, Wuhan 430200, Hubei Province, China

Zhao-Di Guo, Qin Cao, Department of Hand Surgery, The First People Hospital of Jiangxia District, Wuhan 430200, Hubei Province, China

Corresponding author: Xiao-Wei Zhu, MD, Chief Physician, Department of Operating Room, The First People Hospital of Jiangxia District, No. 1 Cultural Avenue, Jiangxia District, Wuhan 430200, Hubei Province, China. xiaoweizhu0818@163.com

Abstract

BACKGROUND

The recovery time of hand wounds is long, which can easily result in chronic and refractory wounds, making the wounds unable to be properly repaired. The treatment cycle is long, the cost is high, and it is prone to recurrence and disability. Double layer artificial dermis combined with autologous skin transplantation has been used to repair hypertrophic scars, deep burn wounds, exposed bone and tendon wounds, and post tumor wounds.

AIM

To investigate the therapeutic efficacy of autologous skin graft transplantation in conjunction with double-layer artificial dermis in treating finger skin wounds that are chronically refractory and soft tissue defects that expose bone and tendon.

METHODS

Sixty-eight chronic refractory patients with finger skin and soft tissue defects accompanied by bone and tendon exposure who were admitted from July 2021 to June 2022 were included in this study. The observation group was treated with double layer artificial dermis combined with autologous skin graft transplantation ($n = 49$), while the control group was treated with pedicle skin flap transplantation ($n = 17$). The treatment status of the two groups of patients was compared, including the time between surgeries and hospital stay. The survival rate of skin grafts/flaps and postoperative wound infections were evaluated using the Vancouver Scar Scale (VSS) for scar scoring at 6 mo after surgery, as well as the sensory injury grading method and two-point resolution test to assess the recovery of skin sensation at 6 mo. The satisfaction of the two groups of patients was also compared.

RESULTS

Wound healing time in the observation group was significantly longer than that in the control group ($P < 0.05$, 27.92 ± 3.25 d *vs* 19.68 ± 6.91 d); there was no significant difference in the survival rate of skin grafts/flaps between the two patient groups ($P > 0.05$, 95.1 ± 5.0 *vs* 96.3 ± 5.6). The interval between two surgeries (20.0 ± 4.3 d) and hospital stay (21.0 ± 10.1 d) in the observation group were both significantly shorter than those in the control group (27.5 ± 9.3 d) and (28.4 ± 17.7 d), respectively ($P < 0.05$). In comparison to postoperative infection (23.5%) and subcutaneous hematoma (11.8%) in the control group, these were considerably lower at (10.2%) and (6.1%) in the observation group. When comparing the two patient groups at six months post-surgery, the excellent and good rate of sensory recovery (91.8%) was significantly higher in the observation group than in the control group (76.5%) ($P < 0.05$). There was also no statistically significant difference in two point resolution ($P > 0.05$). The VSS score in the observation group (2.91 ± 1.36) was significantly lower than that in the control group (5.96 ± 1.51), and group satisfaction was significantly higher ($P < 0.05$, 90.1 ± 6.3 *vs* 76.3 ± 5.2).

CONCLUSION

The combination of artificial dermis and autologous skin grafting for the treatment of hand tendon exposure wounds has a satisfactory therapeutic effect. It is a safe, effective, and easy to operate treatment method, which is worthy of clinical promotion.

Key Words: Bilayer artificial dermis; Autologous skin graft; Tendon exposure; Bone exposure

©The Author(s) 2023. Published by Baishideng Publishing Group Inc. All rights reserved.

Core Tip: In this study, the observation group and the control group were treated with Lando double-layer artificial dermis and pedicled skin flap transplantation to repair hand wounds, respectively. There was no significant difference in the survival rate between the two groups of skin grafts/flaps after surgery. However, compared to the control group, the observation group had shorter surgical intervals and hospital stays, and the appearance of the fingers after surgery was better. The observation group also had better skin contracture and scar formation than the control group, resulting in higher satisfaction in the observation group.

Citation: Wang W, Chen DS, Guo ZD, Yu D, Cao Q, Zhu XW. Artificial dermis combined with skin grafting for the treatment of hand skin and soft tissue defects and exposure of bone and tendon. *World J Clin Cases* 2023; 11(33): 8003-8012

URL: <https://www.wjgnet.com/2307-8960/full/v11/i33/8003.htm>

DOI: <https://dx.doi.org/10.12998/wjcc.v11.i33.8003>

INTRODUCTION

As the primary organs used for labor and work, the hands and arms account for the majority of work-related injuries[1, 2]. Hand injuries can have a major impact on a person's social work and everyday activities, causing patients to experience both physical and financial hardship[3,4]. The patient can be greatly impacted by pressure injuries to the hand, and due to the lengthy healing period, chronic and refractory wounds are easily formed, resulting in the wound being inadequately treated. The inability to recover quickly makes it challenging to return to a regular functional state. Patients may continue to have severe problems with the inflammatory response[5-7]. Pressure damage wounds can be chronic and resistant if they are not treated promptly, which will have a major negative impact on the wound's ability to heal[8,9].

The inability of skin and subcutaneous soft tissue to undergo a normal, orderly, and timely repair under the influence of internal and external factors, exhibit a pathological inflammatory response: wound non-healing is the complex formation mechanism of chronic refractory wounds[10,11]. The quality of life is significantly impacted by its intricate pathophysiology, which is frequently incurable, and secondary infections can occur[12]. In addition, the etiology is complicated, the course of therapy is protracted, expensive, and it is likely to reoccur and cause disability. In the medical field, treating refractory wounds is not easy[13]. Tissue engineering advancements have made it possible to treat refractory wounds with a novel approach that combines autologous skin graft with double layer artificial dermis, offering a fresh approach to treating minor finger skin abnormalities. Hypertrophic scars, severe burn wounds, exposed bone and tendon wounds, and postoperative tumor wounds have all been repaired using this approach[14]. This technique can reduce harm to the skin donor area, speed up the healing process, improve the appearance of the healed wound surface, and encourage functional recovery of the hands and feet. It can also lower the chance of scarring and recurrence.

In this study, a prospective analysis of 68 patients with refractory hand wounds admitted to the First People's Hospital of Jiangxia District, Wuhan City from July 2021 to June 2022 was conducted. Double layer artificial dermis combined with autologous skin graft was applied to treat these refractory wounds, which achieved satisfactory results, as described below.

MATERIALS AND METHODS

Clinical data

Sixty-eight patients with chronic and refractory hand wounds who were admitted to our hospital from July 2021 to June 2022 were included in this study. The general information and wound status of these patients are shown in [Table 1](#).

Inclusion and exclusion criteria

Inclusion criteria: (1) Comply with the diagnostic criteria for hand bone and joint injuries in the "Diagnostic Standards for Orthopedic Diseases", with finger skin and soft tissue defects accompanied by tendon or bone exposure, and comply with skin flap transplantation; (2) Receive treatment 12 h after injury; and (3) No severe organ and tissue diseases such as heart, brain, blood vessels, liver, kidney, lung, *etc.*

Exclusion criteria: (1) Individuals with infections in other parts such as the urinary system, respiratory system, *etc.*; (2) People with diabetes, heart disease, and arterial occlusive disease of lower limbs; and (3) Individuals with severe mental, neurological, immune, and hematological disorders.

Methods

After admission, the patients underwent thorough debridement to remove necrotic and degenerative skin, soft tissue, periosteum, and other tissues attached to the wound surface, tendons, and phalanges. The necrotic tendons were removed where appropriate and the periosteum and aponeurosis were preserved as much as possible. After sufficient hemostasis, the wound surface was repeatedly rinsed with hydrogen peroxide and physiological saline.

The observation group was treated with double-layer artificial dermis combined with autologous skin graft. Artificial dermis implantation: A suitable model of double-layer artificial dermis (Lando, Shenzhen Qikang Medical Equipment Co., Ltd.) was selected based on the size and shape of the wound, the artificial dermis was cut to size, soaked in sterile 0.9% physiological saline, the saline was replaced after 5 min, and this procedure was repeated 3 times. A thick needle was used to puncture the artificial dermis for drainage purposes. The upper and lower layers of the artificial dermis were distinguished, collagen was tightly fitted on the wound surface avoiding wrinkles and gaps, and the edges were sown and fixed. The inner layer was covered with sterile Vaseline gauze, and the outer layer was wrapped with sterile gauze. After 3-5 d, the Vaseline gauze and sterile gauze were replaced, and the wound surface covered by the artificial dermis. If fluid accumulated under the artificial dermis, it was squeezed and discharged appropriately. After treatment, Vaseline gauze and sterile gauze use was continued for wrapping. The dressing was replaced every 2-3 d and the condition of the artificial dermis autologous skin grafting was observed: After 2-3 wk, when the color of the artificial dermis changed to reddish yellow or orange, the outer layer of the artificial dermis was removed. Based on the size of the patient's wound, an autologous medium thickness skin graft approximately 0.4 mm thick was obtained from normal skin (forearm). A thick needle was used to appropriately puncture the autologous skin, it was covered with vascularized artificial dermis, and then sutured and fixed. The inner layer was padded with sterile Vaseline gauze, and the outer layer was padded with sterile gauze for wrapping. The skin supply area was covered with sterile Vaseline gauze, and sterile gauze was used for pressure wrapping. The dressing was changed 7-10 d after surgery, survival of the skin graft was determined, and the dressing was then changed every 2-3 d. According to the survival status of the skin graft, the dressing and sutures were removed 12 to 14 d after surgery.

The control group was treated with pedicle flap transplantation using an abdominal pedicle flap. The skin flap was designed based on the size of the finger wound and the flap extended 20% beyond the area of the finger skin defect. Layered intermittent suturing repair of the flap donor area was performed. The affected finger was placed in the appropriate position of the abdominal skin flap, the skin flap was intermittently sutured and the skin margin of the finger wound the flap has a broken pedicle. Four weeks after surgery, the pedicle of the abdominal pedicle skin flap was performed.

Observation indicators

The following treatment outcomes in the two groups of patients were compared: (1) The interval between two surgeries and hospitalization time; (2) Wound healing through complete closure and epithelialization of the wound edge; and (3) The survival rate of skin grafts by assessing the proportion of active skin fragments on the wound surface.

The following postoperative wound infections between the two groups of patients were compared: (1) The amount of exudate using the Falange score of 4, with 1 being the minimum value; 2: Moderate; and 3: Out of control; and (2) Assessment of subcutaneous hematoma.

The postoperative wound recovery in the two groups of patients was compared as follows: (1) Skin sensation recovery after 6 mo using the sensory injury grading method and two-point resolution test. With regard to the sensory injury grading method S5: Completely normal sensation; S4: Some pain and tactile sensation with two-point discrimination; S3: Some pain and tactile sensation; S2: Pain and local touch; S1: Deep pain; S0: No sensation. S0 and S1 were considered poor, S2 and S3 were considered good, and S4 and S5 were considered excellent. The excellent rate and good rate were calculated; The two-point discrimination test, with higher scores and smaller distances indicated better finger recovery; and (2) After 6 mo, the Vancouver Scar Scale (VSS) was used to evaluate scar status in the receptor area, which included four aspects: color, vascular distribution, thickness, and softness, with a score of 0 to 15 points; The higher the score, the greater the scarring, and vice versa.

Satisfaction in the two groups of patients was compared using a questionnaire at the end of the sixth month of follow-up, with the score ranging from 0 to 100. The higher the score, the higher the patient satisfaction.

Table 1 General information on the study patients

Variable	Observation group	Control group
Sex (male/female)	42/7	14/3
Age, yr (mean $\pm$ SD)	45.18 $\pm$ 14.04	45.94 $\pm$ 13.06
BMI	26.72 $\pm$ 6.35	27.08 $\pm$ 5.07
Wound area, cm ² (mean $\pm$ SD)	3.6 $\pm$ 0.47	3.7 $\pm$ 0.43
Exposed area, cm ² (mean $\pm$ SD)	3.0 $\pm$ 0.32	3.1 $\pm$ 0.35
Leakage type (Tendon/bone)	5/45	1/17

BMI: Body mass index.

Statistical analysis

Data analysis was conducted using SPSS 26.0 statistical software. The chi square test was used to compare differences in categorical variables, such as postoperative wound infection and subcutaneous hematoma. For continuous variables, a normality test was first performed. For variables with a normal distribution, such as exudate volume and VSS, independent sample testing was used to compare differences and the values are reported as mean $\pm$ SD (standard deviation). $P < 0.05$ indicates a statistically significant difference.

Ethical considerations

All adult subjects provided written informed consent, and all clinical studies followed the principles of the Helsinki Declaration. Prior to analysis, all patient data were anonymous. The patients agreed in writing to the use of accompanying photographs in research, reports, and publications. The implementation of clinical monitoring was to monitor whether informed consent was obtained from all selected patients, whether the treatment process had been carried out correctly, and whether the recorded data were sufficient and accurate.

RESULTS

All 68 cases of chronic and refractory wounds of the hand healed. After wound healing all patients were discharged and followed up once a month for 6 mo.

Postoperative wound condition of the patients

Table 2 and Figure 1 show that the interval between two surgeries (20.0 ± 4.3 d) and hospitalization time (21.0 ± 10.1 d) in the observation group (artificial dermis combined with autologous skin graft transplantation) were significantly shorter than those in the control group (skin flap transplantation) (27.5 ± 9.3 d) and hospitalization time (28.4 ± 17.7 d), ($P < 0.05$), but the wound healing time in the observation group was significantly longer than that in the control group ($P < 0.05$, 27.92 ± 3.25 d *vs* 19.68 ± 6.91 d); There was no significant difference in the survival rate of skin grafts/flaps between the two groups of patients ($P > 0.05$, 95.1 ± 5.0 *vs* 96.3 ± 5.6). The rates of postoperative infection (10.2%) and subcutaneous hematoma (6.1%) in the observation group were significantly lower than those in the control group (23.5%) and (11.8%), respectively. At 6 mo after surgery, the excellent and good rate of sensory recovery in the observation group (91.8%) was significantly higher than that in the control group (76.5%) ($P < 0.05$), and there was no statistically significant difference in two-point resolution between the two groups of patients ($P > 0.05$); The VSS score in the observation group (2.91 ± 1.36) was significantly lower than that of the control group (5.96 ± 1.51), and satisfaction in the observation group was significantly higher than that in the control group ($P < 0.05$, 90.1 ± 6.3 *vs* 76.3 ± 5.2).

Typical cases

Figures 2 and 3 show representative cases of the natural progress of skin grafts after surgery in the two groups.

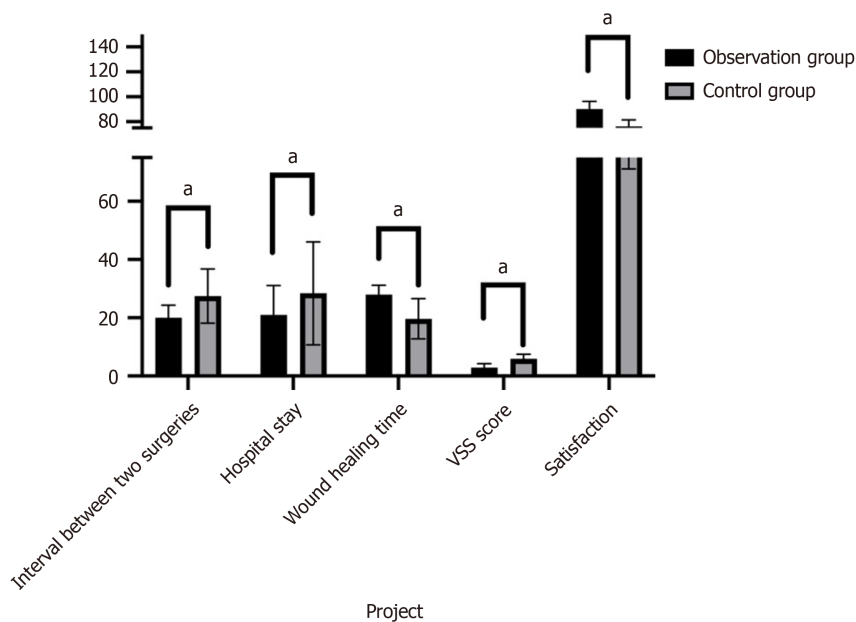
DISCUSSION

Exposed wounds of hand and foot tendons are extremely common in the clinical work of hand and foot surgeons and burn plastic surgeons. Due to the extremely important role of hands and feet in the daily life of patients, priority should be given to the function and aesthetic appearance of the affected limb when deciding on the repair method for such wounds[15]. Free flap transplantation is currently the most widely used treatment method for full-thickness skin defects [16]. However, as people's pursuit of beauty continues to improve, restoration of the appearance of hand and foot wounds after injury is increasingly valued, and the main factor affecting the appearance is excessive scar hyperplasia. Studies have shown[17-19] that the main cause of scar formation is contraction of the wound surface. Inhibiting the

Table 2 Postoperative wound conditions, *n* (%)

Variable	Observation group	Control group
Interval between two surgeries (d)	20.0 ± 4.3	27.5 ± 9.3
Hospital stay (d)	21.0 ± 10.1	28.4 ± 17.7
Wound healing time (d)	27.92 ± 3.25	19.68 ± 6.91
Skin graft/flap survival rate	95.1 ± 5.0	96.3 ± 5.6
Postoperative infection	5 (10.2)	4 (23.5)
Subcutaneous hematoma	3 (6.1)	2 (11.8)
Recovery of skin sensation		
Optimal	25 (51.0)	5 (29.4)
Good	20 (40.8)	8 (47.1)
Poor	4 (8.2)	4 (23.5)
Two point resolution		
≥ 7 mm	18 (36.7)	10 (58.5)
4-6 mm	31 (63.3)	7 (41.2)
VSS score	2.91 ± 1.36	5.96 ± 1.51
Satisfaction	90.1 ± 6.3	76.3 ± 5.2

VSS: Vancouver Scar Scale.

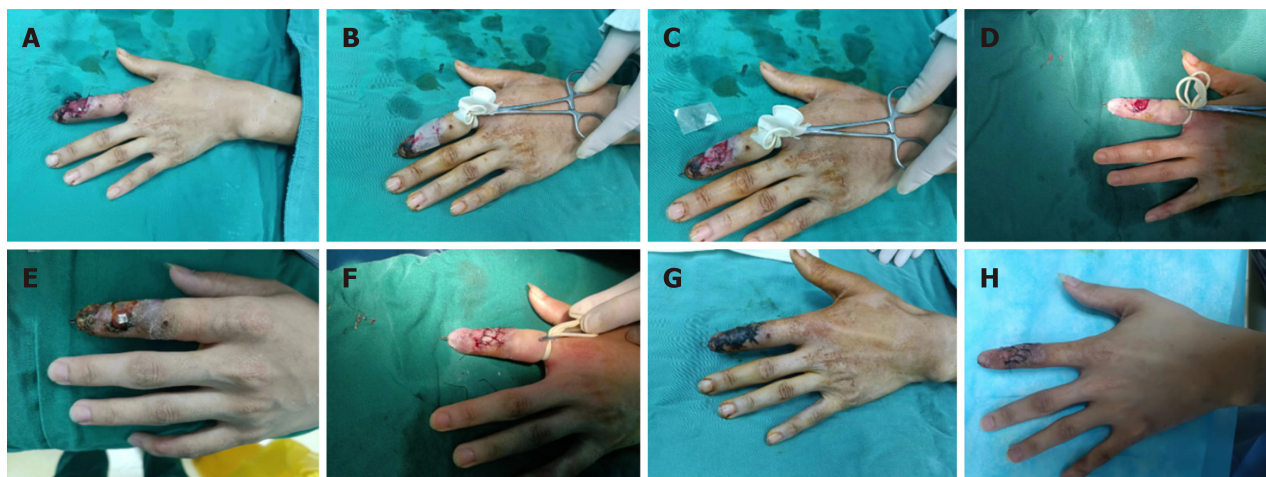


DOI: 10.12998/wjcc.v11.i33.8003 Copyright ©The Author(s) 2023.

Figure 1 Significant differences in the time between surgeries, hospital stay, wound healing time, Vancouver Scar Scale score, and satisfaction between the artificial dermis combined with skin flap transplantation group and the skin flap transplantation group ($P < 0.05$).

contraction of the wound surface helps to promote scar free regeneration, while artificial dermis, as a wound contraction inhibitor, can eliminate contraction and achieve scar minimization when used to treat soft tissue defects. Currently, artificial dermis has been widely used in the repair of burns, severe injuries, and non-healing wounds, and has achieved satisfactory results[20-22]. However, there are few reports on the application of artificial dermis combined with autologous skin patches in exposed wounds of hand and foot tendons.

Double layer artificial dermis is a substitute for dermis, with characteristics such as biomimetic and biodegradable properties[23]. The domestically produced double-layer artificial dermis Lando is composed of a medical silicone film on



DOI: 10.12998/wjcc.v11.i33.8003 Copyright ©The Author(s) 2023.

Figure 2 Typical case in the observation group: A 53-year-old male patient with skin avulsion and necrosis of the left index finger. A: Physical examination showed a defect in the radial skin and soft tissue of the distal segment of the left index finger, with exposed bones and tendons. No fracture was found on preoperative X-ray examination; B: Left index finger debridement under local anesthesia and double layer artificial dermis (Lando) transplantation; C and D: Two weeks after surgery, the double layer artificial dermis was removed, and the exposed wound of the left index finger tendon bone was fresh and completely covered with granulation tissue; E: Under local anesthesia, left middle finger wound debridement and free forearm thick skin graft transplantation were performed, followed by postoperative pressure bandage; F and G: One week after removal of the compression pack, the skin graft on the affected finger wound survived well and the wound healed completely; H: After surgery, the skin grafting wound on the left index finger was smooth, with slight pigmentation and mild scar formation. The function of the injured finger recovered well. During follow-up, the patient was satisfied with the appearance and functional recovery of the wound, and the final Vancouver Scar Scale score was 2.0.



DOI: 10.12998/wjcc.v11.i33.8003 Copyright ©The Author(s) 2023.

Figure 3 Typical case in the control group. A: A 32-year-old male patient with degloving injury of the distal segment of the left index, middle, and ring fingers. Physical examination showed skin and soft tissue defects of the distal segment of the left index, middle, and ring fingers, with exposed bones and tendons. No fractures were found on preoperative X-ray examination; B: Left index and ring finger abdominal pedicle flap under local anesthesia; C: The appearance of the postoperative flap was relatively bulky, and its function was acceptable, but the feeling was not good. During follow-up, the patient was generally satisfied with the appearance and functional recovery of the wound, and the final Vancouver Scar Scale score was 6.0.

the surface layer and a bovine Achilles tendon collagen and polysaccharide removed from the end peptide on the lower layer. The semi-transparent medical silicone film on its surface has biomimetic functions, which can play a role in breathability, controlling moisture, and blocking bacteria. It has suitable flexibility, can fit the wound surface and has mechanical strength, ensuring the sealing of the wound and reducing the risk of infection. The lower dermis has a degradable function, and its sponge-like scaffold layer guides the inward migration, proliferation, and gradual maturation of vascular endothelial cells and capillaries to form new blood vessels and dermal regeneration, reducing scar formation, contracture, and restoring skin elasticity[24]. Artificial dermis is commonly used to repair burn wounds and has gradually been used in recent years to repair exposed wounds of bones and tendons[25].

Artificial dermis is divided into a silicone membrane on the surface and a collagen sponge on the bottom. The collagen sponge provides a scaffold for the orderly growth of fibroblasts and the formation of capillaries on the wound surface, constructing dermoid tissue with a rich blood supply, covering exposed tendons and bone tissue, thereby providing a good transplant bed for autologous skin graft transplantation and promoting skin graft survival. Therefore, patient satisfaction and the incidence of limb deformities in the observation group in the present study were better than those in the control group. In addition, due to the similar composition and structure of artificial dermis to natural human skin, it can guide the growth of cells and blood vessels, thereby achieving orderly regeneration and permanent reconstruction of dermal tissue[19]. When the artificial dermis is fully vascularized, the silicone membrane is removed and a very thin layer of autologous skin is transplanted onto the newly formed granulation tissue, achieving effects similar to medium or even full thickness skin transplantation. Therefore, in this study, patients with exposed hand and foot tendons were treated

with artificial dermis combined with autologous skin grafting. Due to the traditional free skin flap transplantation, the donor site healing time, wound surface, and scar growth in the donor site were repaired.

In this study, Lando double-layer artificial dermis and pedicled skin flap transplantation were used to repair wounds in the observation group and the control group, respectively. There was no significant difference in the survival rate of the skin graft/flap between the two groups after surgery. However, the observation group had shorter surgical intervals and hospital stays compared to the control group, and the postoperative appearance of the fingers was better. Skin contracture and scar formation after repair surgery are also important factors in evaluating the effectiveness of repair. We assessed the VSS score of the patient's wound surface during a follow-up period of 6 mo after surgery, and the results showed that the VSS score in the observation group was significantly lower than that in the control group. This indicated that Lando double-layer artificial dermis combined with autologous skin grafting is an effective method for repairing finger skin and soft tissue defects with bone and tendon exposure. In addition, the results of this study showed that with the prolongation of time after surgery, both groups of patients gradually recovered finger sensation, and the observation group had a significantly higher sensory recovery score at 6 mo after surgery than the control group, indicating that the use of Lando double-layer artificial dermis for wound repair was more effective than pedicle skin flap transplantation. This may be because newly generated fibroblasts and capillaries in the adjacent tissues after implantation of artificial dermis are immersed in the pores of the collagen sponge layer, and degrade to form a dermal-like granulation tissue matrix. On this basis, thin skin grafting was carried out, effectively reducing epidermal contracture and scar hyperplasia, and improving finger sensation recovery and flexibility. The proportion of patients in the observation group who had a 2-point resolution of 4-6 mm was higher than that in the control group at 6 mo after surgery, despite the fact that there was no significant difference in two-point resolution between the two groups. This finding may be related to the bias resulting from the small number of cases.

The results of this study show that compared with traditional skin flap repair methods, the application of artificial dermis in wound repair has the following advantages: (1) It can significantly inhibit scar growth and reduce skin contracture; (2) It can directly cover exposed tendons, reduce tendon adhesion, and create an excellent transplantation bed for blade thick skin grafting; (3) Increase the thickness and quality of soft tissue to achieve thinner autologous epidermal transplantation, minimizing trauma to the donor site; (4) After wound healing, the appearance is close to normal, effectively avoiding secondary scar repair; and (5) The surgical time is short, the surgery is simple and easy to perform, and the risk is low.

The results of this study indicate that thorough debridement of the wound surface is crucial before using double-layer artificial dermis, which is an important foundation for smooth vascularization of the artificial dermis[26,27]. In addition, we found that newly formed dermal tissue slowly grows inward from the outer edge of the wound, gradually covering the exposed bones and tendons until they are completely covered. Therefore, when double-layer artificial dermis is used to cover the wound, it should cover the fresh tissue at the edge of the wound to ensure successful vascularization of the artificial dermis and lay a solid foundation for later skin grafting. Infection and hematoma on the wound surface are the most common causes of failure in artificial dermis transplantation; thus, thorough debridement, hemostasis, and postoperative pressure bandages are all important for postoperative efficacy[28]. We chose to change the dressing for the first time 3-5 d after surgery, observe the condition of the wound, and if hematoma or infection was present, they were removed in a timely manner. The remaining artificial dermis can still be successfully vascularized, and measures such as a gauze dressing soaked with physiological saline containing antibiotics such as gentamicin or combined with negative pressure drainage can be applied. During the treatment process, the treatment strategy can be adjusted in a timely manner according to the patient's actual situation[29].

However, as reported in some studies[30,31], there are also some problems with the combination of artificial dermis and autologous skin graft repair: (1) This technology inevitably involves secondary surgery; in our study, patients in the observation group had longer wound healing time than those in the control group, and some patients in the observation group were dissatisfied with the long treatment cycle; (2) Although artificial dermis is relatively expensive, due to the obvious scars, transfer flap surgery often requires secondary scar repair treatment; thus, the overall cost increase is not significant. Therefore, in order to compare the hospital stay, cost, and surgical frequency of artificial dermis combined with autologous skin flap repair with traditional skin flap repair, a cost-benefit analysis is still needed; (3) The anti-infection ability of artificial dermis is poor, and the combination of artificial dermis and autologous blade thickness skin grafting requires strict aseptic procedures; and (4) The formation of hematoma is a common complication of artificial dermis and can easily lead to interruption of healing and loss of artificial dermis. Therefore, the combination of artificial dermis and autologous skin graft requires careful hemostasis and appropriate fixation.

The limitation of our research is that firstly, this graduate student center is small; therefore, our sample size was limited and larger studies are needed to determine the clinical efficacy of treatment with artificial dermis combined with skin grafting. Secondly, this study did not take into account factors that may affect wound recovery, such as the patient's job type, and whether they smoke or drink alcohol.

CONCLUSION

In summary, it is preliminarily believed that the combination of artificial dermis and autologous skin graft has a satisfactory therapeutic effect on hand tendon exposure wounds. It provides a safe, effective, and easy to operate treatment method, which is worthy of clinical promotion.

ARTICLE HIGHLIGHTS

Research background

When paired with autologous skin transplantation, double layer artificial dermis can promote functional recovery of hands and feet, limit damage to the skin donor area, improve the appearance of the healed wound surface, speed up the healing process, and lower the chance of scar formation and recurrence.

Research motivation

Treatment of chronic and refractory skin and soft tissue defects of the fingers with exposed bones and tendons.

Research objectives

To explore the clinical effect of double layer artificial dermis combined with autologous skin graft in repairing chronic refractory skin and soft tissue defects of the fingers with exposed bone and tendon.

Research methods

Sixty-eight chronic refractory patients with finger skin and soft tissue defects accompanied by bone and tendon exposure admitted to our hospital were selected and divided into the observation group (double layer artificial dermis combined with autologous skin grafting) and the control group (pedicle skin flap transplantation). The treatment status of the two groups of patients was compared, as well as the survival rate, scar formation, recovery, and patient satisfaction with skin grafts/flaps at 6 mo after surgery.

Research results

Recovery, postoperative infection, treatment, and patient satisfaction were better in the observation group than in the control group. Skin sensation recovery and skin graft/flap survival rate did not significantly differ between the control and observation groups.

Research conclusions

The combination of artificial dermis and autologous skin graft has a satisfactory therapeutic effect on hand tendon exposure wounds.

Research perspectives

The combination of artificial dermis and autologous skin grafting can be an effective method for treating hand tendon exposed wounds.

ACKNOWLEDGEMENTS

I would like to express my gratitude to all those helped me during the writing of this thesis. I acknowledge the help of my colleagues, they have offered me suggestions in academic studies.

FOOTNOTES

Co-first authors: Wei Wang and Dong-Sheng Chen.

Author contributions: Wang W and Chen DS designed the research; Wang W, Chen DS, Guo ZD, Cao Q, and Yu D performed the research; Zhu XW contributed new reagents/analytic tools; Zhu XW, Guo ZD, Cao Q, and Yu D analyzed the data; Wang W and Chen DS wrote the paper; All authors were involved in the critical review of the results and have contributed to, read, and approved the final manuscript. Wang W and Chen DS contributed equally to this work as co-first authors. The reasons for designating Wang W and Chen DS as co-first authors are threefold. First, the research was performed as a collaborative effort, and the designation of co-corresponding authorship accurately reflects the distribution of responsibilities and burdens associated with the time and effort required to complete the study and the resultant paper. This also ensures effective communication and management of post-submission matters, ultimately enhancing the paper's quality and reliability; Second, the overall research team encompassed authors with a variety of expertise and skills from different fields, and the designation of co-first authors best reflects this diversity. This also promotes the most comprehensive and in-depth examination of the research topic, ultimately enriching readers' understanding by offering various expert perspectives; Third, Wang W and Chen DS contributed efforts of equal substance throughout the research process. The choice of these researchers as co-first authors acknowledges and respects this equal contribution, while recognizing the spirit of teamwork and collaboration of this study. In summary, we believe that designating Wang W and Chen DS as co-first authors is fitting for our manuscript as it accurately reflects our team's collaborative spirit, equal contributions, and diversity.

Supported by Clinical Study of Artificial Dermis Combined with Skin Flap Replacement Flap in Limb Wound Repair, No. WX21C27.

Institutional review board statement: This study protocol was approved by The First People's Hospital of Jiangxia District, and all the families have voluntarily participated in the study and have signed informed consent forms.

Informed consent statement: All study participants or their legal guardian provided informed written consent prior to study enrolment.

Conflict-of-interest statement: All authors declare no conflicts of interest related to this study.

Data sharing statement: Data generated from this investigation are available upon reasonable request from the corresponding author.

Open-Access: This article is an open-access article that was selected by an in-house editor and fully peer-reviewed by external reviewers. It is distributed in accordance with the Creative Commons Attribution NonCommercial (CC BY-NC 4.0) license, which permits others to distribute, remix, adapt, build upon this work non-commercially, and license their derivative works on different terms, provided the original work is properly cited and the use is non-commercial. See: <https://creativecommons.org/licenses/by-nc/4.0/>

Country/Territory of origin: China

ORCID number: Xiao-Wei Zhu 0009-0000-4954-4736.

S-Editor: Liu JH

L-Editor: Webster JR

P-Editor: Xu ZH

REFERENCES

- 1 Sozbilen MC, Dastan AE, Gunay H, Kucuk L. One-year prospective analysis of hand and forearm injuries in children. *J Pediatr Orthop B* 2021; **30**: 364-370 [PMID: 32932418 DOI: 10.1097/BPB.0000000000000802]
- 2 Luria S, Talmud D, Volk I, Liebergall M, Calderon-Margalit R. The epidemiology of wrist and hand injury in two hospitals in Jerusalem: substantial differences between population subgroups. *Isr J Health Policy Res* 2019; **8**: 7 [PMID: 30626435 DOI: 10.1186/s13584-018-0278-0]
- 3 Zhang J, Ren J, Liu Y, Huang D, Lu L. Resveratrol regulates the recovery of rat sciatic nerve crush injury by promoting the autophagy of Schwann cells. *Life Sci* 2020; **256**: 117959 [PMID: 32531375 DOI: 10.1016/j.lfs.2020.117959]
- 4 Lee JK, Hwang D, Han SH, Lee Y. Complete Occlusion of Radial and Ulnar Arteries Following Hand Crush Injury with Multiple Carpometacarpal Joint Fracture-Dislocations. *J Hand Surg Asian Pac Vol* 2022; **27**: 376-380 [PMID: 35443882 DOI: 10.1142/S2424835522720122]
- 5 Güntürk ÖB, Kaplan İ, Yıldırım T, Gürbüz Y, Ademoğlu Y, Ada S. Reconstruction of mutilating hand injuries by microsurgical free tissue transfers from the foot. *Injury* 2021; **52**: 3646-3652 [PMID: 33838878 DOI: 10.1016/j.injury.2021.03.044]
- 6 Shrestha S, Tamrakar S, Banskota AK. Outline of Hand and Wrist Injuries Presenting to an Emergency of a Tertiary Care Centre in Nepal. *J Nepal Health Res Counc* 2019; **17**: 340-344 [PMID: 31735929 DOI: 10.33314/jnhrc.v17i3.1806]
- 7 Kerschhagl M, Larcher L, Mattiassich G, Prantl L. Replantation of a circumferentially degloved thumb in an occupational crush injury - A case report and review of the literature. *Clin Hemorheol Microcirc* 2019; **71**: 403-414 [PMID: 31006678 DOI: 10.3233/CH-199004]
- 8 Messana F, Faccio D, Rizzato S, Marchica P, Bassetto F, Vindigni V, Tiengo C. Combining traditional and microsurgical reconstruction after a complex hand trauma with multiple tissue defects. A case report. *Ann Ital Chir* 2021; **10** [PMID: 34569471]
- 9 Zhou H, Yu T. Effect of Comprehensive Rehabilitation Training Program in Orthopedic Nursing of Patients with Residual Limb Injury Caused by Crush. *J Healthc Eng* 2022; **2022**: 6769572 [PMID: 35126938 DOI: 10.1155/2022/6769572]
- 10 Wilkinson HN, Hardman MJ. Wound healing: cellular mechanisms and pathological outcomes. *Open Biol* 2020; **10**: 200223 [PMID: 32993416 DOI: 10.1098/rsob.200223]
- 11 Cheng B, Jiang Y, Fu X, Hao D, Liu H, Liu Y, Huang Z, Tan Q, Wang L, Hu D, Yang Y, Han C, Cheng Z, Ran X, Li Y. Epidemiological characteristics and clinical analyses of chronic cutaneous wounds of inpatients in China: Prevention and control. *Wound Repair Regen* 2020; **28**: 623-630 [PMID: 32585756 DOI: 10.1111/wrr.12825]
- 12 Raziyeve K, Kim Y, Zharkinkbekov Z, Kassymbek K, Jimi S, Saparov A. Immunology of Acute and Chronic Wound Healing. *Biomolecules* 2021; **11** [PMID: 34066746 DOI: 10.3390/biom11050700]
- 13 Falanga V, Saap LJ, Ozonoff A. Wound bed score and its correlation with healing of chronic wounds. *Dermatol Ther* 2006; **19**: 383-390 [PMID: 17199681 DOI: 10.1111/j.1529-8019.2006.00096.x]
- 14 Boyce ST, Lalley AL. Tissue engineering of skin and regenerative medicine for wound care. *Burns Trauma* 2018; **6**: 4 [PMID: 30009192 DOI: 10.1186/s41038-017-0103-y]
- 15 Lv Z, Yu L, Wang Q, Jia R, Ding W, Shen Y. The use of dermal regeneration template for treatment of complex wound with bone/tendon exposed at the forearm and hand, a prospective cohort study. *Medicine (Baltimore)* 2019; **98**: e17726 [PMID: 31689814 DOI: 10.1097/MD.00000000000017726]
- 16 Wang Y, Xu R, Luo G, Lei Q, Shu Q, Yao Z, Li H, Zhou J, Tan J, Yang S, Zhan R, He W, Wu J. Biomimetic fibroblast-loaded artificial dermis with "sandwich" structure and designed gradient pore sizes promotes wound healing by favoring granulation tissue formation and wound re-epithelialization. *Acta Biomater* 2016; **30**: 246-257 [PMID: 26602823 DOI: 10.1016/j.actbio.2015.11.035]
- 17 Rippa AL, Kalabusheva EP, Vorotelyak EA. Regeneration of Dermis: Scarring and Cells Involved. *Cells* 2019; **8** [PMID: 31216669 DOI: 10.3390/cells8060607]
- 18 Yannas IV, Tzeranis DS, So PTC. Regeneration of injured skin and peripheral nerves requires control of wound contraction, not scar formation. *Wound Repair Regen* 2017; **25**: 177-191 [PMID: 28370669 DOI: 10.1111/wrr.12516]
- 19 Yannas IV, Tzeranis DS, So PTC. Regeneration mechanism for skin and peripheral nerves clarified at the organ and molecular scales. *Curr Opin Biomed Eng* 2018; **6**: 1-7 [PMID: 29392187 DOI: 10.1016/j.cobme.2017.12.002]
- 20 Verbelen J, Hoeksema H, Pirayesh A, Van Landuyt K, Monstrey S. Exposed tibial bone after burns: Flap reconstruction versus dermal substitute. *Burns* 2016; **42**: e31-e37 [PMID: 26376411 DOI: 10.1016/j.burns.2015.08.013]
- 21 Chen X, Chen H, Zhang G. Management of wounds with exposed bone structures using an artificial dermis and skin grafting technique. *Clin*

- Plast Surg* 2012; **39**: 69-75 [PMID: 22099850 DOI: 10.1016/j.cps.2011.09.011]
- 22 **Seavey JG**, Masters ZA, Balazs GC, Tintle SM, Sabino J, Fleming ME, Valerio IL. Use of a bioartificial dermal regeneration template for skin restoration in combat casualty injuries. *Regen Med* 2016; **11**: 81-90 [PMID: 26681342 DOI: 10.2217/rme.15.83]
- 23 **Qiu X**, Wang J, Wang G, Wen H. Vascularization of Lando® dermal scaffold in an acute full-thickness skin-defect porcine model. *J Plast Surg Hand Surg* 2018; **52**: 204-209 [PMID: 29320909 DOI: 10.1080/2000656X.2017.1421547]
- 24 **Wang W**, Zhang L, Sun L, She ZD, Tan RW, Niu XF. Biocompatibility and Immunotoxicology of the Preclinical Implantation of a Collagen-based Artificial Dermal Regeneration Matrix. *Biomed Environ Sci* 2018; **31**: 829-842 [PMID: 30558703 DOI: 10.3967/bes2018.110]
- 25 **Karami A**, Tebyanian H, Sayyad Soufdoost R, Motavallian E, Barkhordari A, Nourani MR. Extraction and Characterization of Collagen with Cost-Effective Method from Human Placenta for Biomedical Applications. *World J Plast Surg* 2019; **8**: 352-358 [PMID: 31620338 DOI: 10.29252/wjps.8.3.352]
- 26 **Widjaja W**, Tan J, Maitz PKM. Efficacy of dermal substitute on deep dermal to full thickness burn injury: a systematic review. *ANZ J Surg* 2017; **87**: 446-452 [PMID: 28304144 DOI: 10.1111/ans.13920]
- 27 **Nilforoushzadeh MA**, Sisakht MM, Amirkhani MA, Seifalian AM, Banafshe HR, Verdi J, Nouradini M. Engineered skin graft with stromal vascular fraction cells encapsulated in fibrin-collagen hydrogel: A clinical study for diabetic wound healing. *J Tissue Eng Regen Med* 2020; **14**: 424-440 [PMID: 31826321 DOI: 10.1002/term.3003]
- 28 **Hicks KE**, Huynh MN, Jeschke M, Malic C. Dermal regenerative matrix use in burn patients: A systematic review. *J Plast Reconstr Aesthet Surg* 2019; **72**: 1741-1751 [PMID: 31492583 DOI: 10.1016/j.bjps.2019.07.021]
- 29 **Ribeiro LM**, Guerra AS. [Hidradenitis Suppurativa: Combined Treatment with Dermal Template, Skin Graft and Negative Pressure Wound Therapy, a Case Study]. *Acta Med Port* 2018; **31**: 59-62 [PMID: 29573770 DOI: 10.20344/amp.8656]
- 30 **Yeong EK**, Yu YC, Chan ZH, Roan TL. Is artificial dermis an effective tool in the treatment of tendon-exposed wounds? *J Burn Care Res* 2013; **34**: 161-167 [PMID: 23292584 DOI: 10.1097/BCR.0b013e3182685f0a]
- 31 **Yeong EK**, Chen SH, Tang YB. The treatment of bone exposure in burns by using artificial dermis. *Ann Plast Surg* 2012; **69**: 607-610 [PMID: 23154329 DOI: 10.1097/SAP.0b013e318273f845]



Published by **Baishideng Publishing Group Inc**
7041 Koll Center Parkway, Suite 160, Pleasanton, CA 94566, USA

Telephone: +1-925-3991568

E-mail: bpgoffice@wjgnet.com

Help Desk: <https://www.f6publishing.com/helpdesk>

<https://www.wjgnet.com>

