

Fingertip Injuries Conservative Management with Dressing: A Systematic Review

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ABSTRACT

Introduction: Fingertip traumatic injuries are known as the most common injuries to the hand. Conservative management is one of the treatment approaches that is purposed to promote secondary healing in fingertip injuries. This article reviews the current best evidences and concepts about recent developments in conservative management using dressing in fingertip injuries.

Methods: A literature search was carried out to determine potential studies for this review up to November 20th 2020. The search was performed using the PubMed/MEDLINE, Embase, Cochrane Library, and Google Scholar databases including keywords that matched the MeSH rule and the term used for fingertip injuries and conservative management.

Results: The search strategy generated several diverse literatures presenting a variety of conservative management in fingertip injuries. A total of 6 studies were included in the review. Satisfactory healing outcomes were found in most of the studies. Tissue healing as assessed by pulp regeneration was found in 4 of the 6 studies studied. Improvement of normal functions from the aspect of fingertip sensibility is also no different compared to non-conservative management. Satisfaction of

aesthetic aspects were also found in the studies, although some complications can still be observed.

Conclusion: Conservative management with dressings allows patients to avoid long immobilization with satisfactory results in clinical healing outcomes, complication, and aesthetic measures. However, comparative studies are still limited; thus, further studies are needed to provide more advanced statistical result as to whether type of conservative management is superior to each other in fingertip injuries.

Keywords: *fingertip injury, digital injury, conservative, dressing*

INTRODUCTION

The fingertip is the part of human body which is located on the most distal portion of extremities. Anatomically, it is located on the terminal phalanx, which is on the distal to the insertion of the flexor digitorum superficialis and extensor tendons of the distal phalanx or the interphalangeal joint of the thumb. Due to its anatomical property, fingertips are highly prone to trauma. Fingertip traumatic injuries are the most common injuries to the hand with the estimation of 4.8 million visits every year (Sindhu *et al.*, 2017). Serious fingertip trauma also often results in amputation. The

incidence rate of fingertip amputation in the United States is estimated at 7.5/10,000 population with total number of surgeries reaching 45,000 procedures every year (Vergara-Amador, Castillo-Pérez and Tovar-Cuellar, 2016) (Reid *et al.*, 2019).

Common injuries of fingertip may be classified into variant degree of severities based on the involvement of the injured tissue. Allen classified the injury into: (1) type 1 injuries that only involves the pulp, (2) type 2 fingertip injury that involves the pulp and the nail bed, (3) type 3 fingertip injury that involves partial loss of the distal phalanx, and (4) type 4 fingertip injury that involves the part of phalanx which is proximal to the lunula (Vergara-Amador, Castillo-Pérez and Tovar-Cuellar, 2016).

The severity of the injury determines the choice of the best treatment to achieve the maximum recovery results. The main goals of treatment are to maintain the sensibility and resistance at the fingertip and ensure proper bone support for nail growth. The fingertips are essential in providing the tactile and sensibility function because the fingertips have a high concentration of sensory receptors. Therefore, sensation recovery is the main focus of treatment. Additionally, nail tip resistance or durability is very important for finger and hand movement. The last final goal is to restore the nail growth, which is a key factor in preserving appearance (Kawaiah *et al.*, 2020).

Conservative management is one of the treatment approaches that is purposed to promote secondary healing. This type of treatment does not entail the patient to undergo surgery but is managed by applying simple dressing. Small defect fingertip injuries with no bony and tendon involvement, and less than two centimeters skin loss, are often classified not viable for surgery and preferred to dress the wound to support secondary healing (Krauss and Lalonde, 2014). Healing method by conservative management is favored because it is simpler and can be more effective compared to other approaches of

treating an injured fingertip (Kawaiah *et al.*, 2020). Conservative management with dressing in fingertip injuries is challenging among surgeons because there are many considerable options with their respective advantages and disadvantages. The purpose of this study is to review the conservative management with dressing based on the best available evidences.

MATERIALS & METHODS

Search Strategy

A literature search was undertaken to determine potential studies for this review up to November 20th 2020. The search was performed using the PubMed/MEDLINE, Embase, Cochrane Library, and Google Scholar databases including keywords that matched the MeSH rule and the term used for fingertip injuries (“fingertip injuries” OR “fingertip trauma” OR “fingertip amputation”) and the term used for conservative management (“conservative” OR “non-operative” OR “non-surgical” OR “dressing” OR “secondary healing” OR “secondary intention”). Fingertip injury is defined as any soft tissue loss, nail or bony injury distal to the insertion of the long flexor muscle and extensor tendons on the distal phalanges. Conservative management is defined as any kind of non-surgical management that involves applying a simple dressing to the injury.

The selection and review process were done manually by two independent reviewers. The references of the selected studies that eligible to the inclusion and exclusion criteria of this review were also additionally reviewed, including the studies that were not present in the initial search. The main focus of this review is to compare and analyze different clinical outcomes of conservative management in fingertip injuries based on the clinical outcomes, complication, and aesthetic aspect of the healing.

Inclusion and Exclusion Criteria

Inclusion criteria include any research investigating fingertip injuries treated by the

conservative management with dressing within the past ten years, that is published in English language, has an abstract, and involves humans as the subject in the study. Given the limited number of studies, there was no restriction in terms of patient's demographics. Exclusion criteria include any single case reports, review articles, and any research of fingertip injuries treated by surgical or operative management.

RESULT

The search strategy generated several diverse literatures including pediatric and adult patients presenting a variety of

conservative management in fingertip injuries. The evidence ranges from level I, II, III, and IV. The total of 43 researches regarding fingertip injuries that treated conservatively were identified. On the basis of titles and abstracts screening, a total of 34 researches were excluded. The remaining articles were subsequently studied by two independent reviewer based on the full text extracted. A list of inclusion and exclusion criteria previously agreed by the authors were utilized for screening the full text. This selection process yielded 6 final articles to be included in the review and was depicted in Figure 1.

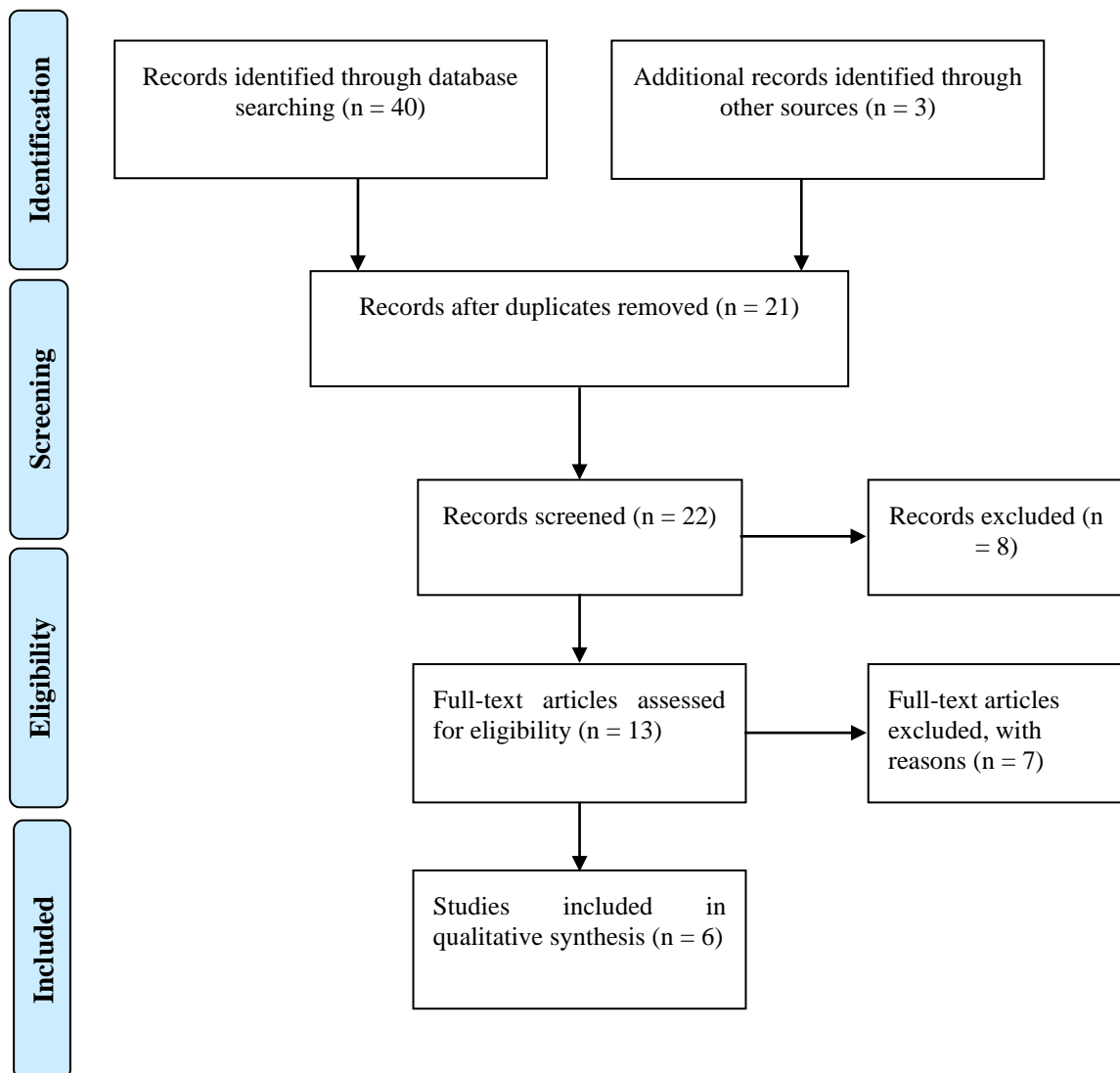


Figure 1. Flow diagram describing the strategy for conducting this study based on PRISMA guideline.

Table 1. Characteristic of the studies

No.	Reference	Journal	Study Design	Level of Evidence
1.	Seiler M <i>et al.</i> (2020)	Journal of Hand Surgery	Prospective cohort study	II
2..	Van den Berg <i>et al.</i> (2012)	J Trauma Acute Care Surg	Retrospective cohort study	III
3.	Hoigne <i>et al.</i> (2013)	Journal of Hand Surgery	Comparative prospective study	III
4.	Ha <i>et al.</i> (2015)	Journal of Wound Care	Non-comparative prospective study	IV
5.	Rafter L <i>et al.</i> (2013)	Wounds UK	Non-comparative prospective study	IV
6.	Schultz <i>et al.</i> (2018)	GMS Interdiscip Plast Reconstr Surg	Comparative prospective study	III

Table 2. Characteristic of the study populations

No.	Reference	Total Sample Size	Mean Age (Age range in year)	Male	Female	Type of Dressing
1.	Seiler M <i>et al.</i> (2020)	50	3 (1-13)	29	N/A	Ointment dressing (containing: chlorhexidine and despanthenol)
2.	Van den Berg <i>et al.</i> (2012)	59	42.6	52	7	Silver sulfadiazine, petroleum jelly-coated dressings
3.	Hoigne <i>et al.</i> (2013)	17	41 (21-69)	12	5	OpSite® Flexiflix® dressing
4.	Ha <i>et al.</i> (2015)	15	47.6 (22-77)	13	N/A	Intravenous (IV3000®) dressing
5.	Rafter L <i>et al.</i> (2013)	11	N/A (7-70)	9	2	PolyMem® finger/toe dressing (containing: glycerin)
6.	Schultz <i>et al.</i> (2018)	34	7 (1-13)	10	12	Silicon cap dressing

Table 3. Summary of outcomes of the conservative management with dressing in fingertip injuries

No.	Reference	Type of Dressing	Follow up Duration	Healing outcomes	Complications	Aesthetic outcomes
1.	Seiler M <i>et al.</i> (2020)	Ointment dressing (containing: chlorhexidine and despanthenol)	Day 5, day 10, day 21, 6 month	N/A	N/A	No significant mean difference between ointment dressing and surgical approach based on Nail Appearance Score (NAS) and Patient and Parental Nail Satisfaction Score (PPNS).
2.	Van den Berg <i>et al.</i> (2012)	Silver sulfadiazine, petroleum jelly-coated dressings	52-54 months	The strength, sensibility, and mobility, cold intolerance was statistically similar to surgical approach.	Infection, nail deformity, and neuroma were observed although the comparison was not statistically significant.	Higher satisfaction score was observed although the comparison was not statistically significant.

3.	Hoigne <i>et al.</i> (2013)	OpSite® Flexiflix® dressing	6-18 months	The difference of soft tissue regeneration, sensibility was nearly similar to non-injured hand.	No complication observed.	The skin healed almost without scarring and the dermal ridges reformed.
4.	Ha <i>et al.</i> (2015)	Intravenous (IV3000®) dressing	18-24 months	Subjective satisfaction was found in 13 out of 14 subjects, although only 8 out of 14 regained normal pulp thickness.	Hypersensitivity and numbness were observed.	Nail deformity was observed.
5.	Rafter L <i>et al.</i> (2013)	PolyMem® finger/toe dressing (containing: glycerin)	7 days	Subjective satisfaction in all subjects due to minimal scarring, easy and painless application.	N/A	Subjective satisfaction in all subjects due to good cosmetic appearance.
6.	Schultz <i>et al.</i> (2018)	Silicon cap dressing	1-7.5 months	Satisfactory epithelization time, and restriction in sensibility and motility	No hypersensitivity and infection observed.	No nail deformity observed.

DISCUSSION

A variety of different dressing have been suggested based on several studies, including ointment dressing (chlorhexidine and dexpanthenol, silver sulfadiazine, petroleum jelly-coated), semi-occlusive/occlusive dressings, and vacuum/sub-atmospheric dressings. Each technique presented its own advantages based on its clinical outcomes, complications, and aesthetic satisfaction.

Ointment Dressings

Studied the use of conservative approach using ointment, without replacing nail compared to the surgical nail plate refixation for fingernail avulsion among children. Conservative management consisted of the wound cleansing and disinfection followed by the application of non-adherent ointment dressing with chlorhexidine and dexpanthenol. Dry gauze was then applied and the dressing was regularly changed. This study primarily measured the appearance of nail growth using Nail Appearance Score (NAS),

followed by patient's and parent's satisfaction to the healing using Patient and Parental Nail Satisfaction Score (PPNS). Based on statistical analysis, this study found that the outcome measures of conservative treatment are not inferior to the surgical approach (NAS mean difference -0.02; 95% CI: -0.05; 0.01 and PNSS mean difference -0.06; 95% CI: -0.27; 0.02). Mean duration of analgesic use was also shorter among conservative group compared to surgical group (mean difference -0.8; 95% CI: -0.31; 2.32). Complication such as infection was not found in either group (Seiler *et al.*, 2020).

Another conservative ointment dressing in fingertip injuries was studied. This study retrospectively compared fingertip injuries treated using silver sulfadiazine, petroleum jelly-coated dressing, and surgically using V-Y advancement reconstruction and full-thickness skin graft. The objective outcomes assessments include the grip and pinch strength, sensibility, and reduction in mobility of all finger joints, whereas the subjective outcomes assessments include the

cold intolerance, nail deformation, and aesthetics. This study concluded that neither method was superior to each other, although the results seem to be in favor of conservative treatment. However, the author mentioned that this result may be due to a small number from the conservative group compared to surgical group; thus, further comparative study with bigger sample is needed (Van Den Berg *et al.*, 2012).

Semi-occlusive/Occlusive Dressings

Hoigne *et al.*, identified the quantitative regeneration parameter in fingertip injuries treated with OpSite® Flexiflix® compared to opposite non-injured hand. OpSite® Flexiflix® is a semi-occlusive dressing with reactive moisture vapour transmission rate (MVTR) of 650 g/m²/24 hours. Reactive MVTR is the rate at which water vapour passes through the dressing material (Ha *et al.*, 2015). The quantitative parameter was measured based on the thickness of soft tissue in the former injury, the extent of soft tissue surrounding the bone, the static two-point discrimination, and the regeneration of papillary ridges based on fingerprint. In comparison to the opposite non-injured hand, the study showed only small differences among variative measurement parameter. Fingerprint analysis revealed a practically scar-free regeneration of the dermal ridges. The duration of the conservative treatment using this type of semi-occlusive dressing was 6.5 weeks on average. Subjective valuation showed that all patients were satisfied with the treatment, that they would prefer it to surgical approach. However, more advanced statistical analysis was needed to obtain accurate superiority of this type of dressing (Hoigné *et al.*, 2014).

Ha *et al.*, studied the application of intravenous (IV3000®) dressings in fingertip injuries. Intravenous dressing is a semi-occlusive dressing which is known to have 16 times higher MVTR that allows the injured fingertip to maintain a moist bed to support epithelialization without the risk of maceration; thus, resulting in better healing

environment. Other advantages of IV dressing include easy and painless application, having a non-porous composition that prevent microbial contamination, water-resistance, transparency that allow visual assessment of healing, and low economic cost. Subjective valuation from the patients showed 14 fingertip injuries treated with IV3000® dressing with satisfactory results and only 1 fingertip injury showed indifferent result. On further study done by Cerny *et al.* (2018), it was described that the use of IV3000® as an occlusive dressing induced an early activation of mesenchymal stem cells (MSC) and inhibition of fibroblast proliferation, which later improve the organization of collagen in tissue healing process. This is known to be responsible for satisfactory wound healing under occlusive environment (Ha *et al.*, 2015).

Rafter *et al.*, studied the use of PolyMem® finger/toe dressing containing glycerin, which is a moisturizer that prevents the wound adherent, reduces odor, soothes the traumatic tissue, supports autolytic debridement, and manages wound fluid. This dressing was considered beneficial to the patients because it provides optimum environment for healing and minimize the need of dressing change. Subjective valuation from the patients also suggested satisfactory results because of easy and painless application. However, a comparative study is needed to obtain a more accurate statistical analysis regarding the clinical healing outcomes from the use of PolyMem® dressing in fingertip injury (Rafter and Oforka, 2013).

Newly method of semi-occlusive conservative dressing was performed by Schultz *et al.*, The study was carried out using a silicone finger cap, which is a thin and soft shaft that surrounds the base of the finger and provides the semi-occlusive seal without the need for additional adhesives. The cap was splinted along the injured finger and the excess wound fluid during the healing process would be aspirated weekly from its reservoir. This type of dressing

provides advantages over other conventional semi-occlusive dressings, which usually do not stick well to wet skin. Outcome measures include the clinical aspect, complication, and microbiology evaluation. Good and indifferent clinical outcomes were observed between the silicone cap dressing and conventional semi-occlusive dressing based on epithelization time, hypersensitivity, and restriction in sensibility and motility. Serious complications and infection were absent in both methods, although a wide spectrum of bacterial growth was detected on microbial analysis. Currently, the use of silicone finger cap for fingertip injuries is being developed and studied further in a randomized clinical trial (Schultz *et al.*, 2018).

Vacuum Dressings

Vacuum dressing is another dressing alternative, that is routinely used in fingertip injuries. A custom-made vacuum is applied by connecting an aspiration catheter (size 12-Fr or 14-Fr) and 20-mL or 50-mL syringe to the injured finger, covered with a sterile drape. The plunger of syringe is then drawn to ensure sub-atmospheric environment to the wound. The syringe must be discharged when wound fluid is collected to prevent bacterial infection. Unfortunately, the use of vacuum dressings is still reported in single reports. Therefore, comparative studies are solely needed to compare the use vacuum dressing to other available dressings (Aydin *et al.*, 2011) (Fok and Fung, 2015).

Among the various types of conservative management techniques with dressings that applied in fingertip injuries, satisfactory healing outcomes were found in most of the studies. Tissue healing as assessed by pulp regeneration was found in 4 of the 6 studies. Improvement of normal functions from the aspect of sensibility is also no different compared to non-conservative management. Complication such as post-injury hypersensitivity, infection, and neuroma was found in only one study. Meanwhile,

satisfaction with aesthetic aspects can also be found to be better in the conservative compared to other methods, although some aesthetical complications such as nail deformity can still be found. The limitation of these studies is that they have relatively different time of observation, so that the comparison of the healing time in each conservative management cannot be studied further. In addition, several studies are still non-comparative; therefore, more advanced studies are needed to provide further advantages and disadvantages between each conservative dressing managements.

CONCLUSION

Fingertip injuries should not be taken lightly as they can result in significant morbidity if poorly treated. Conservative management with dressings has been discussed based on several literatures found, such as ointment dressing (chlorhexidine and despanthenol, silver sulfadiazine, petroleum jelly-coated), semi-occlusive/occlusive dressings, and vacuum/sub-atmospheric dressings. Conservative management allows patients to avoid long immobilization with satisfactory results in clinical outcomes, complication, and aesthetic measures. However, comparative studies regarding these techniques are still limited. Systematic comparative study and controlled trials are sorely needed to provide more advanced statistical result regarding the truth as to whether type of conservative management is superior to each other in fingertip injuries.

Declaration by Authors

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