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Health technology assessment on super oxidized water for treatment of chronic wounds

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Abstract

Background: Super oxidized water (SOW), as a novel antiseptic solution, is used with claims of effectiveness and cost effectiveness in healing chronic wounds such as diabetic foot, infectious post-operative ulcers and burn ulcers. We conducted a health technology assessment to evaluate the clinical evidence from clinical and randomized trials for this disinfection. This study aims to evaluate the safety, effectiveness and cost-effectiveness of this technology in Iran, for using as a wound disinfectant.

Methods: Systematic literature searches were conducted from October 2013 to March 2014 for the following medical databases: OVID MEDLINE, CINAHL, the Cochrane Library and the PICO terms were included and then analyzed by Cochrane assessment criteria.

Results: Out of 705 articles, twelve potentially relevant trials were identified. Others that didn't come with the PICO criteria were excluded. 5 randomized controlled trials, 5 clinical trials, a rapid HTA and a case series that had studied the effectiveness of super oxidized water on patients with different chronic wounds, were included. Most of these trials were assessing similar sets of outcomes as the Safety and Effect on Healing days to re-epithelization, healing rate, effect on Infection bacterial counts and infection rates.

Conclusion: Super oxidized water is a safe, effective and cost effective irrigation and cleansing agent due to the performed analysis in comparison with current treatment as povidone iodine for treating wound infections.

Keywords: Super oxidized water (SOW), Betadine, Chronic wound, Cost, Antiseptic.

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Introduction

There has been a rapid increase in the use of medical technologies in the recent years. It is clear that proper use of these technologies can significantly improve the patients' conditions; however, uncontrolled and inappropriate use of them might lead to a waste of limited resources (1).

Such issue has been more seen in developing countries and has resulted in an increase in costs. Therefore, it is better that a comprehensive study is done by assessing the criteria for a new technology to conclude whether it is efficient, cost effective and locally acceptable to be established in any country (2). One of these crucial issues in health service systems is known as infection control.

Researchers consider infection control as a key issue and the first line of defense. This factor can almost be a thorough approach to patients and also hospitals (3).

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Chronic wound is a significant health problem that many patients with various diseases are suffering from. Most chronic wounds are categorized into 3 main types: pressure ulcers, venous ulcers and diabetic ulcers (4). Wound healing has a complex procedure and interaction that is understood at molecular level (5).

In 2006, statistics also showed the burden of such wounds on health systems. As we see, 5 million patients in United States suffer from chronic wounds. This costs 20 billion dollars per a year(1986to 1999) that more than 50% of it, is possessed to pressure ulcers (6,7).

Ang stated that "Super-Oxidized' Water (SOW) is a novel antiseptic solution, sold over-the-counter in pharmacies. Studies have shown that 'Super-Oxidized' Water can be used to inhibit the growth of harmful viruses, fungi and bacteria in wounds. "Super- Oxidized' Water is produced by exposing sodium chloride through a semi-permeable membrane and then using electrolysis to produce oxychlorine ions" (Fig. 1). The mechanism of this cleansing agent is reported by infiltrating the walls of free living microbes without any harm to human cells (8). This product has got the US Food and Drug Administration approval (US FDA 510k). It's characteristic is to moisten, lubricate and debride wounds (9).

Researchers from many countries as US, UK, Japan, India, Malaysia have investigated the product as a disinfectant for instruments and hard, inanimate surfaces in hospitals, a cleansing agent for hand washing and ulcers, an irrigyant solution for mediastinal post-operative wounds (10).

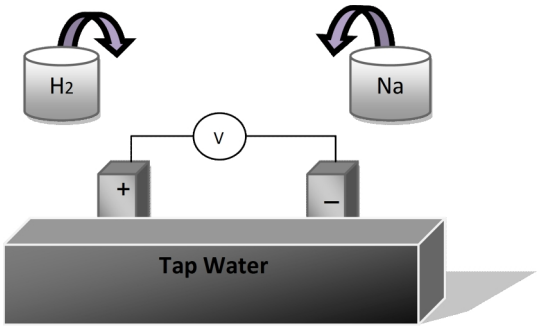


Fig. 1. Production of Electrolyzed Water

Besides, applicants indicated that SOW has no hazardous, no irritating and no sensitizing nature to skin (11).

Research Questions

1. What is the current treatment of wound healing in Iran?
2. Would it be safe to apply super oxidized water in comparison with the current technology?
3. Would it be effective to apply super oxidized water in comparison with the current technology?
4. Is this technology cost effective?
5. Could we apply super oxidize water as wound disinfectant in Iran?

Study Objectives

In this study, we assessed the relevant randomized control trials and clinical trials for quality appraisal of the super oxidized water (safety, effectiveness, cost effectiveness) on healing chronic and infectious ulcers. The main aim of this review is to find out whether it is an appropriate decision to use this antiseptic in our country or not. Such information may help decision makers in importing, distributing and applying the very health technology.

Methods

Scope

For our analysis, we first included randomized controlled trials and clinical trials which were in accordance with the key terms. A rapid HTA and case series that had met the criteria were added. During the research, the super oxidized water has many uses in health sector, but here we just focus on the wound healing way of effect. There was no restriction in types of the wound. After researches that were conducted in hospitals and wound wards, we found out that the main second-cure way of the chronic wound in Iran is using povidone iodine or normal saline solution. So the comparator of the very technology was selected as povidone iodine. Data were extracted systematically. We extracted data on animal samples in-vitros, surveys with

Table 1. PICO terms

P	Chronic wound	Diabetic foot, burn ulcer, infectious wound, post-operative wound
I	Super oxidized water (SOW)	Dermacyn, Microcyn, Sterilox, Naturasept
C	Antiseptics	normal saline, Povidone iodine, hydrogen peroxide
O	Effectiveness	Safety and Effect on healing rate, healing time, antibiotic therapy and reduction in infection

the aim of surface disinfection and any information that is not in regard to PICO terms. Any differences in extracted data, which were due mostly to reading errors, were resolved by discussion. The PICO table is shown beneath (Table 1). Before filtering by abstracts, the duplicates were omitted from data. The remained were screened whether it is clinical or non-clinical survey. The article was omitted if it was non clinical. There were some relevant studies that did not have accessibility to their full text. They were removed from the whole body of data too. The remained, formed the included data for this research for further evaluations.

Literature Search

The following databases were searched from October 2013 to March 2014 for the following data sources: OVID MEDLINE, CINAHL, and the Cochrane Library. The search strategy was designed to retrieve all articles on the topic (using the terms: “super oxidized water", "chronic wound"," cost", "antiseptic"). In addition, hand searching was done in Google in order to get more information about super oxidized brands and advertisements. There were no restrictions on the language of publication. For all relevant trials lacking data, we attempted to contact the corresponding authors by email or regular mail for further information. All the articles were pooled in Endnote software to be evaluated by abstracts. The titles and abstracts of the identified articles were independently assessed, and hard copies of all potentially relevant articles were obtained for further evaluation.

For quality appraisal of the included studies (RCTs), we used the Cochrane Collaboration. A structured form was used to collect the data from the included studies. For other articles, the JBI appraisal checklist was done.

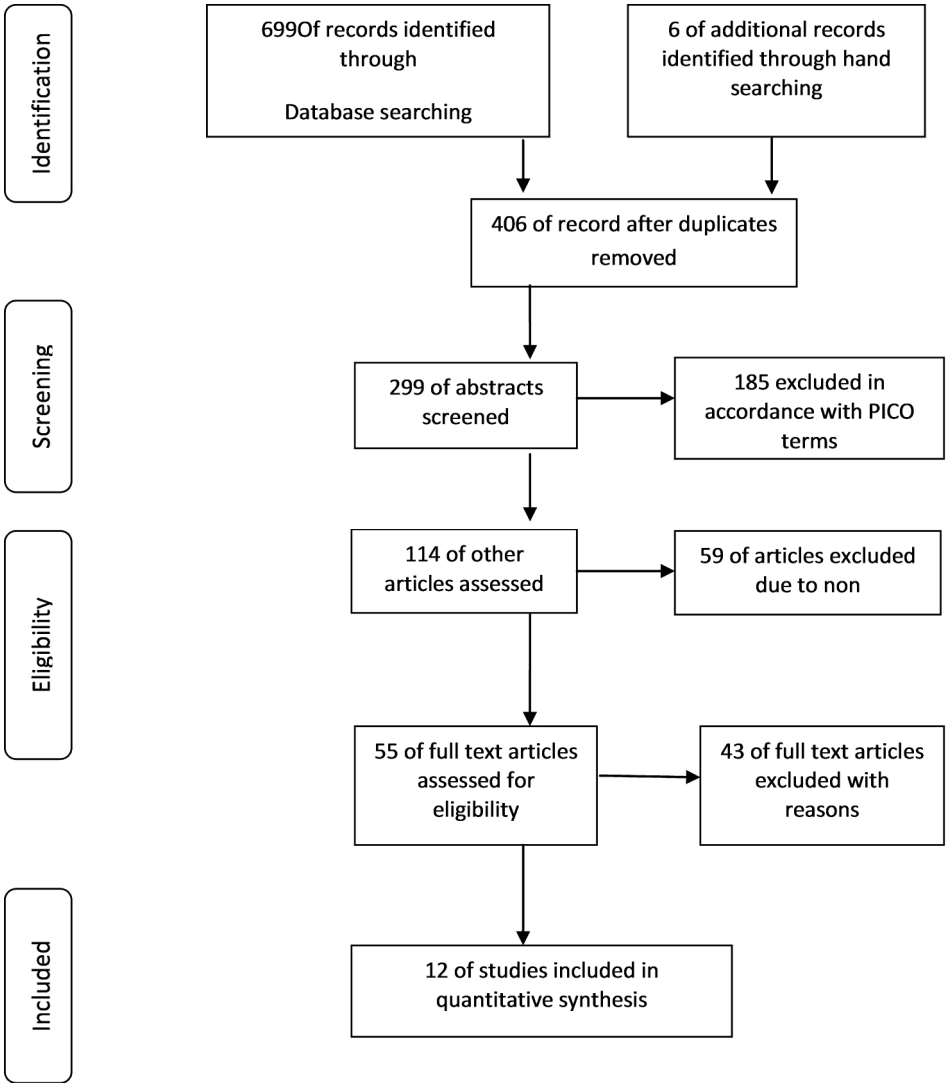
Qualitative analysis was done using thematic synthesis. For the economic evaluation of this technology, the main resource of data was the extracted article and their outcomes during the clinical trials. The final cost of one liter of SOW was calculated per dollar by asking the relevant medical companies and asking authors by email.

The total cost of the current technology (one liter of povidone iodine) was asked from drug and food administration website and some pharmacies. By comparing the efficacy and cost effectiveness of these two technologies the final outcome was gained.

Results

The articles found by systematic search from databases listed above were totally 699 that were surveyed from 1953 till 2014. The duplicate items were primarily omitted from the whole (406 articles) and 161 were related to our subject. The remained were screened by their abstracts. Among them 41 did not have any abstract or full text and were omitted. 58 surveys were about surface disinfection matters, 17 worked on dentistry and 7 were done on animals that all were extracted due to the PICO. At last 6 articles were added to final articles from hand searching in order to negate publication bias. At the end, 12 articles were reached to the next phase, quality assessment. Flow diagram 1 shows the finding process in a glance.

The search revealed 15 studies that were potentially eligible and remained in full text. A total of 12 studies met our inclusion criteria. See the study tables Characteristics of included studies



Flow diagram 1. Flow of papers through the study (12)

A) Included studies

A-1) Study design and setting

From 12 articles included in this review, one is a rapid HTA report that, in spite of making efforts to find the full text, there was no evidence of it. However, the content helped much in the process. Four of all are RCT, a controlled clinical trial and 6 are clinical trials. The remaining are case report and case series all these types of evidence have a high quality of reliability due to EBM pyramid. Of all the articles, two had compared dressing wounds with super oxidized water in comparison with povidone iodine (betadine). Seven of reports were done on patients with diabetic foot ulcers, indicating that super oxidized water can be mostly applicable on diabetic ulcers.

A-2) Duration

The duration of these articles are from 1999 up to 2014. Three articles were done in 2007, three others in 2006, two of them in 2013, two others in 2009,one in 2010,one in 2011,one in 2013 the rest were done in 1999 and 2000. The sum of patients in these 12 surveys is equal to 1252.

A-3) Participants

According to findings, by a short glance we can find out that the most countries that have affiliation to work on this product are the oriental countries rather than European countries. As we see 6 of all were done in Asia (Singapore, Japan, India and Pakistan), 3 in Europe (Italy, Spain), 3 in America (Mexico city, USA, Arizona).

B) Effectiveness

In this review we mention main factors as the outcome of effectiveness such as: healing rate, healing time, antibiotic therapy and reduction in infection.

B-1) Healing rate

Five articles have shown the healing rate of wound by SOW therapy as shown in table2.The report from Piaggesi indicates that the healing rate in control group(super oxidized water) is significantly more than PI(90% v/s 55%, p<0.01) (13). Martinez also came to conclusion that the healing rate of 19 out of 21 around the wound is shown for the SOW group (90.4%) rather that the PI group with 5 out of 16 (31.2%) patient (p=0.001) (14). The healing rate in Kapur's report is said to be 70% for SOW and 50% for PI instead (15). Table 2 shows the results.

B-2) Healing time

Four articles had recorded the days for wounds to be healed as shown in Table3; the findings are indicated per week. Piaggesi has estimated 10.5 weeks for SOW and16.5 weeks for PI to heal a wound with p=0.007 (13). On the other hand, Luca dalla Paula needed 43 days for SOW and 55 days for PI to deal with such wounds in patients (p<0.0001) (16). Other studies from Aragon reported 6.8 weeks for wound to be treated by SOW (17). Table 3 shows the results.

B-3) Antibiotic therapies

Three articles show the needed time to use antibiotics for healing the wounds in table 4; the findings are indicated per week. The duration necessary for antibiotic therapy due to Piaggesi's has been reported as 10.1 weeks for SOW and 15.8 weeks for PI group (p=0.016). Martinez says the time for antibiotic therapy for SOW was 26 days in comparison with 30 days for PI group (14). According to Kapurs' findings, 6 of 100 patients with SOW needed antibiotic therapy whereas 56 of 100 for the PI group (15). Table 4 shows the results.

B-4) Reductions in Infection

Three articles indicated the rate of reduction in SOW therapy in comparison with the current treatment; the findings are shown by percent. Martinez in the tables of findings indicates the decrease in cellulites around wound area after healing them with SOW (80.9%) and PI (43.7%) with p=0.01(14). After 5 days of survey, Chittoria found out that from 20 different wounds treated with SOW, 19 were became sterile

Table 2. Healing rate

	Author	Year	Healing rate (%)		p
			SOW	PI	
1	Chittoria	2007	40	-	-
2	Jesús, Martínez De Fermín, R	2007	90.4	31.2	p=0.001
3	PIAGGESI	2010	90	55	p<0.01
4	Kapur	2011	70	50	-
5	SatishKumar	2013	65	-	-

Table 3. Healing time

	Author	Year	Healing time (week)		p
			SOW	PI	
1	Luca Dalla Paola	2006	6.1	7.8	p<0.0001
2	PIAGGESI	2010	10.5	16.5	p=0.007
3	Kapur	2011	3	3	-
4	Aragón Sánchez	2013	6.8	-	-

Table 4. Antibiotic therapy findings

	Author	Year	Healing time (week)		p
			SOW	PI	
1	Luca Dalla Paola	2006	3-4		-
2	Jesús, Martínez De Fermín, R	2007	3.8	4.3	-
3	PIAGGESI	2010	10.1	15.8	p=0.16

Table 5. Reduction in Infection

	Author	Year	Healing time (%)		p
			SOW	PI	
1	Chittoria	2007	95	-	-
2	Jesús, Martínez De Fermín, R	2007	80.9	43.7	p=0.01
3	SatishKumar	2013	28	-	-

and only 1 remained with the positive bacterial culture (18). In an article with 100 patients healed with SOW the findings showed positive culture in 68 and 28% had no growth in microbial culture during 9 days of action (19). Table 5 shows the results.

Despite the fact that some statistics were investigated according to included articles, the lack of standard deviation is seen in most of them. The other fact is that this research is not focusing on a special type of wound; just being chronic ulcer is acceptable for this assessment; however, some of the included articles showed statistics on a special type as diabetic foot ulcers or post-operative infectious wounds. Pooling such data was not possible for authors for developing a Meta-analysis. This information would help researchers for Future one-dimensional studies.

Overally, most of these findings show more effectiveness of using super oxidized solutions in healing chronic wounds rather than using common treatments as povidone iodine (betadine). Outcome result by detail is shown in Appendix 2.

C) Safety

The main complaint of patients from wound treatment is known as unpleasant odor, skin irritations, inhalation problems, and probability of genotoxicity of the antiseptics. Some researchers mentioned that using betadine for wound disinfection may cause some adverse events that probably lessen its popularity. A Study demonstrates that SOW is safe and effective. In comparison with povidone iodine both reducing healing time and the needing of antibiotic therapy (13-16).

All endpoints for using SOW including reduction of bacterial load, healing times, side effects were better than the ones for the PI group. Altogether, the results show the efficacy and safety of this neutral SOW in wound care (16).

Most of the studies here emphasize the safe nature of the PH neutral SOW mainly because of its non-side effect, irrigation of wound and attack on single celled organism without any harm to multi cellular organisms (14-17,19). Table 6 shows the comparison of superoxide water with iodine in a quick view.

D) Economic Evaluation

Super oxidized water, owing to its low cost, can provide an economical alternative to the other available antiseptic agents (6,14).

According to Lucca dalla Paolla findings, the cost-effectiveness calculations showed that the cost of SOW is more than the time using PI (euro 4.35 versus 2.93) for wound treatment per each day, but when calculated overall besides other factors in favor of SOW, the mean costs of SOW will be less than PI. In addition, the quality of life is more improving in case of healing wound with SOW in comparison with PI group due to faster healing time and less adverse

Table 6. Comparison of superoxide water with iodine

Outcomes	Min-Max		Conclusion	Related articles
	SOW	Betadine		
Healing rate	6.9-65%	50-62.5%	Sow> betadine	6
Healing time	5.1-3 weeks	5.16-8.7 weeks	Sow> betadine	4
Antibiotic therapy	3-1. weeks	3.4-8.15 weeks	Sow> betadine	5
Bacterial load	88-100% reduction	11-25% reduction	Sow> betadine	4
Infection control	9.8-28%	7.43-28%	Sow> betadine	4
hospitalization	4.16-5 days	-	-	4
Side effects	0-7 %	4-7.16%	Sow> betadine	5

Table 7. Cost Effectiveness results

Costs criteria	Betadine/500ml	SOW/500ml	Conclusion
Direct costs	132000RL	255233 RL	Sow< betadine
Side effects	With side effect	None	Sow> betadine
Equipment need	None	None	Sow= betadine
Additional medicines	None	None	Sow= betadine
Custom costs	None	None	Sow= betadine
transportation	None	135592	Sow< betadine

effects from the antiseptic (16). Piagessi et al claim that the cost of SOW is lower than standard treatment with a spare of 40% on the total expenditures, especially due to less antibiotic therapy and following surgical procedures (13). The final results of the cost effectiveness of these two solutions are shown in Table 7.

Discussion

Super oxidized water will be an appropriate alternative to currently available antiseptics for disinfection of surfaces and wounds. This product is processed by aqueous solution electrochemically, that is manufactured from pure water and sodium chloride (NaCl) (8,16). This study represents 12 independent reports of using SOW for wounds. Super oxidized solutions have also other applications on hospital equipment, surface cleansing, and hand washing before an operation, however the focus of this review is just on the healing aspect of the very solution on mostly chronic wounds such as diabetic foot ulcers, post-operative infectious wounds, burns and amputations. The main advantage of pH-neutral SOW is the least skin irritation and its longer shelf time rather than commonly used antiseptics.

The safety findings from included articles indicate that this technology has been effective and safe when applied in different ways (e.g., spray, immersion, irrigation, irrigation), as well as in combination with other technologies (10). It should be noted that antiseptics such as SOW are considered as an adjuvant treatments superior to necessary medicines as antibiotics.

Lucca Dalla Paula mentioned Dermacyn (SOW) would be an effective solution for diabetic foot ulcers, if it is applied besides an appropriate regimen. Although it is more expensive than betadine per liter, by increasing the healing rate, the total cost of SOW would be less than betadine (16).

Following a study by Gutiérrez, there was some concern about the potential induction of genotoxicity of SOW. After micronucleus experiments in accordance with ISO standards, such claim has been resolved and shown that SOW is non genotoxic as well (10).

Effectiveness of the SOW is admitted in all of the included articles from each criterion rather than the commonly used antiseptic like povidone iodine (betadine). By measuring the endpoints of each survey we can come to conclusion that using SOW for wound treatment lessens the time to heal the damaged area, decreases the hospitalization rate, reducing unpleasant odor around the ulcers, and we found it to be efficient with significant improvement in appearance of granulation tissue and epithelization (19). The last but not the least is that because of the nature of neutrality of this product, the attack is also against the anaerobic agents as bacteria, viruses, fungi and spores and by using this antiseptic, there is no hazard to healthy cells around the wound. This criterion is not acceptable when using betadine for wound disinfection.

In addition, there were other factors in favor of SOW usage that are not quantifiable in cost-saving terms. The patients' quality of life apparently improved as a result of using SOW due to faster healing time, the elimination of the unpleasant odor from necrotic tissue and bacterially colonized wounds, and the elimination of local adverse effects from the antiseptic (16).

Ohno said that SOW is a good solution

for irrigating the post-operation wound as bypass surgeries against infection. The survey claims that SOW can destruct the cell wall of agents in 10 seconds. It has no malodor during usage on the ulcers (20).

Conclusion

This study shows that the super oxidized water is a safe and effective solution for chronic wounds. The use of SOW as an adjunct local antimicrobial treatment produced improved outcomes over PI due to recent studies all over the world. More randomized controlled trials and cost analysis are needed to show the cost effectiveness of this product independently.

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Appendix 1. Data extraction form

	Title	Author	Year	Country	Method	Sample size	Outcomes	Conclusion
1	Is 'Super-Oxidized 'Water Effective as an Antiseptic in Wound Care?	Ang SY, Lim JFY	2009	Singapore	HTA	364	Safety and Effect on Healing e.g. days to re-epithelization, healing rate. Effect on Infection eg bacterial counts, infection rates	SOW is suitable as irrigation and cleansing agent in wound care. Nonetheless, more large-scale studies is necessary to establish the safety, efficacy and cost-effectiveness of 'Super-Oxidized'
2	A randomized controlled trial to examine the efficacy and safety of a new super-oxidized solution for the management of wide postsurgical lesions of the diabetic foot	A. Piaggesi MD et al.	2010	Italy	RCT	40	healing rate, healing time, time to achieve negative cultures, duration of antibiotic therapy, number of re-interventions, and adverse events	DWC is as safe as and more effective than standard local antiseptics in the management of wide postsurgical lesions in the infected diabetic foot
3	A randomized controlled trial to examine the efficacy and safety of a new super-oxidized solution for the management of wide postsurgical lesions of the diabetic foot	Fermı´n R Martı´nez-De Jesu´ s et al.	2007	Mexico city	RCT	45	odor reduction, infection control, Cellulitis reduction	A non-toxic, NpHSS, as part of a comprehensive care regimen, may be more efficacious in infection control, odor and erythema reduction than conventional disinfectants in treatment of diabetic foot infections.
4	Super-Oxidized Solution (SOS) Therapy for Infected Diabetic Foot Ulcers	Luca Dalla Paola, MD et al	2006	Italy	CCT	218	reduction in bacterial load from the lesion, healing time, and incidence of skin reactions	SOS is effective and safe in treating infected foot lesions when included within a comprehensive wound care regimen.
5	Treating infected diabetic wounds with super oxidized water as anti-septic agent: a preliminary experience	Hadi, Syed Fazle et al	2007	Pakistan	RCT	100	duration of hospital stay, downgrading of the wound category, wound healing time and need for interventions	The results of SOW for the management of infected diabetic wounds are encouraging. Further RCTs are warranted. It may offer an economical alternative to other expensive antiseptics with positive impact on the end points.
6	Evaluation of effect and comparison of superoxidised solution (oxum) v/s povidone iodine (betadine)	Kapur, Vanita et al	2011	India	RCT	200	reduction in wound size, edema/erythema, Pus discharge, epithelization	Oxum treated wounds showed reduction in inflammation and their healing earlier than betadine. Oxum application was safe having no pain and allergic manifestation
7	The role of super oxidized solution in the management of diabetic foot ulcer: our experience	Chittoria, Ravi Kumar et al	2007	India	Clinical trial	20	Healing rate, infection control, hospitalization days	The moistening effect and minimum toxicity found with the use of this SOW makes it a good choice for diabetic foot ulcer management. How-

								ever, new controlled trials must be conducted
8	Superoxidised solution in the management of lower limb ulcers: our experience	SatishKumar, R et al	2013	India	Clinical trial	100	Wound disinfection, Decrease in wound size, Appearance of Granulation tissue and Duration of Hospital stay	Superoxidised solution is safe and effective in lower limb ulcers, and efficient with significant improvement in appearance of granulation tissue and reduction in duration of hospital stay.
9	Advanced wound care with stable, super-oxidized water	Wolvos, Tom A	2006	Arizona	Clinical Trial	17	Toxicity, irrigation, wound disinfection	Dermacyn also appears to be safe to use with tissue-engineered Products and dermal substitutes. Further clinical studies will help confirm the effectiveness and compatibility of Dermacyn in the field of advanced wound care
10	Super-Oxidized Solution (Dermacyn Wound Care) as Adjuvant Treatment in the Postoperative Management of Complicated Diabetic Foot Osteomyelitis	Aragón-Sánchez, Javier et al	2013	Spain	Clinical Trial	14	healing without recurrence of the infection, need for amputation, side effect	Using DWC in the postoperative period of surgery for DFO when the wound is open is safe and may help eradicate the infection when combined with antibiotic treatment. Additional controlled studies are necessary
11	Superoxidized water improves wound care outcomes in diabetic patients	Bongiovanni, CHERYL M	2006	USA	Case series	8	bacterial load, healing rate	SOW is effective in reducing bacterial load, enhancing local blood supply, accelerating development of neovascularity and providing a wound environment that is hostile to opportunistic organisms
12	Mediastinal irrigation with superoxidized water after open-heart surgery: the safety and pitfalls of cardiovascular surgical application	Ohno, Hideaki et al	2000	Japan	Clinical Trial	25	Anti-bacterial, fungi and anti-viral activity	SOW had no adverse effect on hemodynamic sans was safe when used as a mediastinal irrigation solution during open heart operation via sternotomy

Appendix 2. Outcome results by detail

Treatment duration	Samples			Average age		Population size	Method	Year	Article code
Days	Betadine	SOW	Total	Betadine	SOW				
24	20	20	40	61.3	62.8	Infected diabetic foot	RCT	2010	Piagesi
20	16	21	45	67.8	61.9	Infected diabetic foot	RCT	2007	Fermin
24	108	110	218	69.6		Infected diabetic foot	CCT	2006	Lucadalla

60	50	50	100	40±11	Diabetic- operative- gangrene ulcer	RCT	2007	Hadi
3	100	100	200		Infected wounds, ulcers, diabetic wounds, abscess, burns	RCT	2011	Kapur
5 day	_	20	20	40-50	Diabetic foot ulcer	CT	2007	Chittoria
21		100		Women=54.65 men=52.25	Lower Limb Ulcers/traumatic and diabetic ulcers	CT	2013	Satishkumar
		26			Mixed	CT	2006	Wolves
			14		Diabetic foot osteomyelitis	CT	2013	Aragon

Appendix 2. Cntd

Outcome criteria									Method	Year	Article code
Antibiotic therapy			Healing time			Healing rate					
Comment	Betadine	SOW	Comment	Betadine	SOW	Comment	Betadine	SOW			
week p=0.16	15.8	10.1	P=0.007weeks	16.5	10,5	X2=9.9P<0.01	0.55	0.9	RCT	2010	Piagesi
Week	4.3	3.8				p=0.001	62.5	90.4	RCT	2007	Fermin
Week		3 to 4	p<0.0001Odd ratio=0.79 95%CI/median	7.8	6.1				CCT	2006	Lucadalla
Percent	56	6			3		50	70	RCT	2011	Kapur
								0.4	CT	2007	Chittoria
								0.65	CT	2013	Satishkumar
Mean	4.5		Week		6.8				CT	2013	Aragon

Appendix 2. Cntd

Outcome criteria									method	year	Article code
side effects		Hospitalization		Infection control			bacterial load				
Betadine	SOW	Comment		Comment	Betadine	SOW	Comment	Betadine	SOW			
11	4						Reduction in bacterial load	11	88	RCT	2010	Piagesi
0	94			P=0.01	43.7	80.9	Percent	75	0	RCT	2007	Fermin
16.7	0			Dehiscence after eradication of infection	19.4	12.7	Strain/median/p=0.0109		11.8	CCT	2006	Lucadalla
	1	50% reduction in comparison to betadine	50				Percent/positive culture	50		RCT	2011	Kapur
		Day	5			95				CT	2007	Chittoria
	56	day	16.4	Percent/in 9 days		28				CT	2013	Satishkumar
	7									CT	2013	Aragon