

# APPLICATION OF CADEXOMER IODINE POWDER TO MINIMIZE BIOFILMS IN DIABETIC FOOT ULCER PATIENTS (DFU) AT GRIYA AFIAT WOUND CARE CLINIC: CASE REPORT

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## Abstract

Every wound in diabetics has the potential to experience a setback in healing into a chronic wound so that the wound also has the potential to form into biofilm. One of the modern dressings commonly used to suppress the growth of biofilm is Cadexomer Iodine Powder. However, there is still limited research that addresses directly related to the effectivity of Cadexomer Iodine Powder towards wound healing. Therefore, this report aims to evaluate effectiveness Cadexomer Iodine Powder on wound healing with biofilm problems at Griya Afiat Makassar's wound care clinic. The study aimed to identify the effectiveness of Cadexomer Iodine Powder in minimizing biofilms in diabetic foot ulcer (DFU) patients. This study was conducted on one patient who was followed prospectively for 32 days from 10 July to 10 August 2019 with 10 treatments. The dressing used for wound care is Cadexomer Iodine Powder. To evaluate the reduction in the number of biofilms performed by the expert wound when treatment continues. Meanwhile, to evaluate the wound healing process, the modified Bates-Jensen Wound Assessment was used. This report shows a decrease in biofilm from the first treatment to the last treatment with the number of biofilms in the first treatment (++++) to a few (+) in the 10th treatment. The treatment also took a short period of time which is 32 days with a wound condition at the beginning of treatment which is 30% of slough and 70% of granulation experiencing a very swift healing in the 10th treatment to 40% of epithelium and 60% of granulation. Cadexomer Iodine Powder is very effective in the process of wound treatment which can be seen through the reduction of biofilms. In addition, wound healing is much better with shorter treatment time as a proof.

**Keywords:** Diabetic Foot Ulcer (DFU); Cadexomer Iodine; Modern Dressing.

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## 1. Introduction

Diabetes mellitus is a lifetime condition that is one of the leading causes of death in the world (Kartika, 2017). In Indonesia itself, the high prevalence of diabetics makes Indonesia one of the top 10 countries with highest Diabetes Mellitus (DM) prevalence (Yusuf et al., 2016). The tendency of the prevalence of chronic wounds which is DM in Indonesia has increased from 2007 which was 1.1% to 2.1% in 2013 (Kemenkes, 2013). One of complication that often occurs in patients with Diabetes Mellitus is diabetic foot injury (International Diabetes Federation, 2017).

Diabetic Foot Wound (DFW) often encountered and feared because the treatment is often disappointing and end in amputation, even death (Langi, 2013). The results of research conducted at endocrine clinics in several regional hospitals in eastern Indonesia showed that from 249 registered patient, the prevalence of risk factors for diabetic foot injury was found to be 55.4%. Meanwhile the

prevalence of diabetic foot injury itself is 12% (Yusuf et al., 2016).

Diabetic ulcer will cause an infection if not treated properly. Majority of patients come with advanced stage diabetic foot ulcers, because 93% of the lesions have a III-V degree according to Wagner classification, in addition lesions usually happens with a state of advanced infection, because 60% of the lesions are grade 3-4 on a PEDIS scale (Cervantes-García & Salazar-Schettino, 2017). To see the severity of the wound also to predict healing of the wound, we can use a classification system and a wound evaluation instrument (Rasyid, Yusuf, & Tahir, 2018). The results showed that most of the patients who visited the wound treatment clinic were patients with the type of chronic wounds (Risma, Tahir, & Yusuf, 2018).

Every non-healing chronic wound must contain biofilm, the results of a study of 185 chronic wounds state that the prevalence of biofilms in chronic wounds is 78.2% (Malone, Bjarnsholt, et al.,

2017). Beside that, Malone et al (2017) in his research entitled "Effect of cadexomer iodine on the microbial load and diversity of chronic non-healing diabetic foot ulcers complicated by biofilm in vivo" stated that based on scanned electron microscopy and fluorescence in situ hybridization confirmed the presence of biofilms in all research samples consisting of 17 people with diabetic foot ulcers.

Wound treatment can be done with traditional and modern dressings. Traditional medicine has antioxidant, anti-inflammatory, antibacterial activity in wound treatment (Nurfiah, Tahir, & Yusuf, 2017). One of traditional medicine that is often used is dragon fruit (Tahir et al., 2017). While for modern dressings that are commonly used include Cadexomer iodine (CI) has supreme benefit compared to various wound dressing of the *Pseudomonas aeruginosa* biofilm in the ex vivo model (Wanna et al., 2017). Previous studies referred only to the effectiveness of Cadexomer Iodine (CI) which was done with laboratory experiments, but still limited research was based on the direct effectiveness of cadexomer iodine powder on the healing of a patient with Diabetic ulcer.

The description above is the background of researchers to observe the development of diabetes foot injuries in patients with biofilm wound problems and the treatment process carried out in patients with modern wound care using Cadexomer Iodine Powder in Griya Afiat Wound Care Clinic. This research can be the basis for further research in observing wound healing. In this study, a patient with a biofilm wound problem was followed for 32 days.

## 2. Method

This research is a study case which carried out prospectively at Griya Afiat Wound Care Clinic. The method of collecting samples in this study is *Nonprobability Sampling* by using an *Purposive Sampling* technique where researchers select a sample directly by considering the inclusion and exclusion criteria appropriate to the research's purpose. The process of treatment and evaluation of wound healing is carried out from 10 July 2019 to 10 August 2019. The type of dressing used is 3 gram of *Cadexomer Iodine Powder* 0.9%. The dressing was sprinkled evenly onto the wound surface. Treatments were carried out 2 times a week with an interval of 3 days. Initial measurements were made at the 1st treatment in the first week while the final measurements were made at the 10th treatment in the 5th week.

To evaluate biofilm in wounds, biofilm characteristics evaluation instruments were used. Evaluations are divided into 5 categories consisting of very many categories (++++), many categories (+++), medium categories (++) , few categories (+), and none (-). Determination of the category is done by wound expert when treatment was undergoing. Meanwhile, to evaluate wound treatment, the used

instrument was modified *Bates Jensen Wound Assessment Tool* (Bates, 2001).

## 3. Result and Discussion

Table 1: Client's Demography

Demography	
Age	: 51 y.o.
Sex	: Female
Occupation	: Housewives
Education	: High School
Ethnicity	: Buginese
Religion	: Islam
Marital Status	: Married

Table 1 show that the patient Mrs. H51 years old. Latest education is high school with occupation as housewives. A Buginese with Islam as her.

Table 2: Injury histories

History of injuries	
Onset	Wounds occurred around 3 months ago
Cause	Client stated that the wound originally caused by the skin of left foot's toe got blistered. It never recovered completely and resulting in the swollen and redden instep
Prior Treatments	Client went to clinics several times but only given blushes and the wound just cleaned with NaCl at home
Treatment received	Currently client intensively treated in Griya Afiat Wound Care Clinic. Client was treated with Antimicrobial Silver Ag, Hidrofobic, and Cadexomer Iodine Powder

Table 2 show that patients had diabetes about 3 years ago. Mrs. H wound is *diabetic foot ulcer* (DFU) which was originally caused by a blistered big toe. The wound did not recover and eventually the instep became swollen and red which later became a new wound on the patient's instep. The patient had taken medication at clinic but it was not continued because the patient said that he only received blushes and had to clean the wound himself at home. Currently, patients choose to take care the wound at the Griya clinic and now undergoing modern wound treatment at Griya Afiat Wound Care Clinic.

Table 3 showed a decrease in biofilm from the first treatment to the end of treatment with the number of biofilms in the first treatment (+++) to a few (+) in the 10th treatment. While for the dominant dressing used is Cadexomer Iodine Powder to overcome the problem of biofilms in wounds.

Table 4 showed the result of the treatment for 5 weeks, there was a decrease in the amount of slough from 30% in the first week to 0% in the 5th week. While epithelial tissue increased from 0% in the first week, to 40% in the 5th week. The size of the wound also reduced from 5 x 3 x 0.75 cm in the first week to 2.5 x 1 x 0.2 in the 5th week.

Table 3: Characteristics of Biofilm and The Technique of Wound

Treatment	Technique of Wound				Characteristics of Biofilm
	Primary Dressing	Secondary Dressing	Tertiary Dressing	Edges Of Wound Management	
1	Antimicrobial Silver + Hidrogel	Low Adherent	Gauze, Hypafix	Zink Zalp	Slough, Maserasi, biofilm (+++)
2	Antimicrobial Silver + Hidrogel	Low Adherent	Gauze, Hypafix	Zink Zalp	Slough, Maserasi, biofilm (+++)
3	Antimicrobia Cadexomer Iodine Powder + Hydrofobik	Low Adherent	Gauze, Hypafix	Zink Zalp	Biofilm (+++)
4	Antimicrobia Cadexomer Iodine Powder + Hydrofobik	Low Adherent	Gauze, Hypafix	Zink Zalp	Biofilm (+++)
5	Antimicrobia Cadexomer Iodine Powder + Hydrofobik	Low Adherent	Gauze, Hypafix	Zink Zalp	Biofilm (++)
6	Antimicrobia Cadexomer Iodine Powder + Hydrofobik	Low Adherent	Gauze, Hypafix	Zink Zalp	Biofilm (++)
7	Antimicrobia Cadexomer Iodine Powder + Hydrofobik	Low Adherent	Gauze, Hypafix	Zink Zalp	Biofilm (++)
8	Antimicrobia Cadexomer Iodine Powder + Hydrofobik	Low Adherent	Gauze, Hypafix	Zink Zalp	Biofilm (+)
9	Antimicrobia Cadexomer Iodine Powder + Hydrofobik	Low Adherent	Gauze, Hypafix	Zink Zalp	Biofilm (+)
10	Antimicrobia Cadexomer Iodine Powder + Hydrofobik	Low Adherent	Gauze, Hypafix	Zink Zalp	Biofilm (+)

Table 4: Evaluation of Wound Treatment

Wound Healing Evaluation	Care to									
	Week 1		Week 2		Week 3		Week 4		Week 5	
	1	2	3	4	5	6	7	8	9	10
Clinical Appearance :										
Necrotic	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Slough	30%	20%	10%	5%	5%	0%	0%	0%	0%	0%
Granulation	70%	80%	90%	95%	95%	100%	95%	85%	80%	60%
Epithelization	0%	0%	0%	0%	0%	0%	5%	15%	20%	40%
Size	5 x 3 x 0.75 cm	4 x 3 x 0.75 cm	4 x 3 x 0.5 cm	4 x 3 x 0.5 cm	4 x 3 x 0.5 cm	4x 2.7 x 0.5 cm	4x 2.5 x 0.2 cm	4 x 2 x 0.2 cm	3 x 1.5 x 0.2	2.5 x 1 x 0.2
Eksudat :										
Volume	High	Hight	High	Hight	Medium	Medium	Medium	Medium	Medium	Low
Viscositas	Medium	Medium	Medium	Low	Low	Low	Low	Low	Low	Low
Odour	Low	Low	Low	Low	Low	-	-	-	-	-
Edges of Wound	Healthy	Healthy	Healthy	Healthy	Healthy	Healthy	Healthy	Healthy	Healthy	Healthy
Paint	0	0	0	0	0	0	0	0	0	0
Infection Status	Local Infection	Local Infection	Local Infectio	Local Infectio	Local Infectio	Local Infectio	Local Infectio	Local Infectio	Local Infectio	Local Infectio
Edema	-	-	n	n	n	n	n	n	n	n

Biofilm plays a crucial role in postponing the healing of wounds (Mori et al., 2019). This report shows that Cadexomer Iodine Powder proven effective to overcome the problem of biofilms in wounds that can be seen through a decrease in biofilms from the first treatment to the last treatment with the number of biofilms in the first treatment (+++) decreased to (+) in the 10th treatment. This is in accordance with the research of Roche et al (2019) which states that the effectiveness of

Cadexomer Iodine has been proven effective towards biofilms in various in vitro models, towards biofilms of *Staphylococcus aureus* that are resistant to methicillin in rat wounds, and clinically in diabetic foot ulcers which got complicated by biofilms. In addition, the effectiveness of Cadexomer Iodine was also explained in the research of Malone et al (2017) regarding the effect of Iodine Cadexomer on microbial burden in chronic diabetic foot ulcers which got complicated by biofilms which stated off

the seventeen samples participating in the research, eleven participants showed a log 10 reduction in microbial load after treatment (range 1-2 log 10) compared to six patients who experienced a reduction of <1 log 10. Reduction in microbial load correlated with reduction of wound proteases before and after treatment ( $P = 0.03$ ). Matthew Malone et al (2019) also explains in his study that 14 of the 18 (78%) samples with diabetic foot ulcer related complications of chronic biopilm infections achieve a reduced load of microbes with a cadexomer iodine.

This report also shows the swift treatment of diabetic foot wounds which is 32 days with the wound condition at the beginning of 30% of slough treatment and 70% of granulation experiencing very swift treatment in the 10th treatment to 40% of epithelium and 60% of granulation. This is confirmed by the results of research conducted by Gifari (2018) which states that the average length of treatment conducted in Griya Afiat Wound Care Clinic which is 62 days with the highest frequency of wound types namely chronic wounds of 86.2%. Yunus (2015) in his study also mentions that the average length of time care for injuries in patients at the etn centre's makassar wound clinic is 1-24 weeks at percentage of 96.5%. The delay in the healing process itself can result from many factors between the age, gender, pattern of life, treatment of wounds, and the presence of disease. Various disease processes can affect a chain of events that are involved in healing wounds and lead to incurable chronic wounds (Han & Ceilley, 2017). Diabetic is one of the factors inhibitory to the healing process. In diabetics, normal development through phases of wound repair is impaired, leading to a state of continuous inflammation and dysfunctional epitel of injury (Dekker et al., 2019).

In addition, in the first and second treatment, a combination of Antimicrobial Silver and Hydrophobics were used as a primary dressing to overcome the problem of sloughing on the patient's wound. Ariyanta (2014) in his research entitled "Preparasi Nanopartikel Silver Dengan Metode Reduksi dan Aplikasinya Sebagai Antibakteri Penyebab Luka Infeksi" observed the application of synthesis of Silver Nanoparticles on wound dressing with the best soaking time for 36 hours. The performance of the soaking results in inhibiting bacterial growth was evaluated through the activity tests on bacteria that cause infection, which are *Eschericia coli*, *Bacillus subtilis*, and *Staphylococcus aureus*. Quantitative test results show that by soaking for 36 hours the percentage of bacterial reduction reaches 100%. Indrayati, Koto, & Mulyadi (2018) in his research also mentioned that there are significant differences between hydrophobic (CutimedSorbact®) and Silver (Acticoat™). Usage of Silver (Acticoat™) have a better response, evidenced by the high cure rate and the time needed to heal faster than expected.

As for the supporting dressing, low adherent and gauze is used to create a moist ambience in the wound area and to avoid the gauze to stick to the wound surface. The balanced moisture in sores facilitated the growth of cells and the proliferation of collages in a healthy noncellular matrix (Kartika, 2015). Understanding the concept of healing a moist wound and choosing a proper dressing is a key concept to support the healing process (Handayani, 2016). The dressing is made from knitted synthetic rayon, the top layer is Non-Woven to prevent bacteria from entering and to make sure exudate sealed-in, the surface is not sticky to the wound, and can provide an ideal ambience for wound treatment (Maryunani, 2015).

#### 4. Conclusion

Cadexomer Iodine Powder is very dependable in treating patients with biofilm problem on wound. Cadexomer Iodine Powder can suppress the growth of biofilms and accelerate the process of wound healing in patients with underlying biofilm wounds

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