



# **Pain management during dressing changes for clients with chronic wounds.**

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Abstract:	Chronic wounds are considered a worldwide epidemic and pain is the most frequent symptom reported by the patients. Pain during dressing changes was ranked as the most unpleasant one. By interfering with dressing-related procedures, pain increases risk for infection and impairs healing processes. The aim of this literature review is to explore strategies for efficient pain management in patients with chronic wound and identify factors that contribute to pain. The author of this study aims to answer following research questions: 1) What are the factors contributing to wound pain? (2) What methods can be used when treated wound related pain? The Coloplast Wound Pain Management Model (2008) was used as a theoretical framework. Findings show that infection, poor pharmacological management, anxiety, wound type, dressing removal and cleansing are the major causes contributing to wound pain. Also, primary care/home setting was linked to increased pain. A holistic pain management should consist of pharmacological and non-pharmacological strategies, such as appropriate dressing regimen, analgesia, documentation and use of assessment tools. Furthermore, a use of local analgesics was also discussed.
Keywords:	Pain, pain management, wound', chronic wound', ulcers, dressings, dressing change
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## **List of abbreviations**

ADL: Activities of Daily Living

AIDS: Acquired Immunodeficiency Syndrome

APS: American Pain Society

CBT: Cognitive Behavioural Therapy

EWMA: The European Wound Management Association

IASP: International Association for the Study of Pain

NHS: National Health Service

NSAIDs: Nonsteroidal anti-inflammatory drugs

PAOD: Peripheral arterial occlusive disease

PHMB: The polyhexamethylene biguanide

SSRIs: Selective Serotonin Reuptake Inhibitors

TENS: Transcutaneous electrical nerve stimulation

TMC: Topical Medical Cannabis

UK: the United Kingdom

QOL: Quality of Life

WHO: The World Health Organization

WUWHS: The World Union of Wound Healing Societies

## FOREWORD

*To cure – occasionally,*

*To relieve – often,*

*To comfort – always.*

*- Hippocrates*

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# 1 INTRODUCTION

This literature review was conducted in hope to raise awareness and deepen knowledge of nursing students about pain in chronic non-burn related wounds and the importance of its efficient management during dressing-related procedures.

The prevalence of chronic wounds is linked to growing elderly population and increasing incidence of lifestyle diseases such as obesity and diabetes. Impaired ability to heal and high incidence of cardiovascular diseases and diabetes makes older people most prone to developing chronic wounds (Järbrink *et al* 2017).

Chronic wounds have become a growing concern for healthcare systems and patients worldwide. The socio-economic burden of chronic wounds is mostly associated with the time they take to heal, hospitalization, materials, an involvement of multi-professional team and loss in patients' productivity.

A survey by Blome *et al* (2014) found that an average time for chronic wound to heal is 26.6 months while Woo *et al.* (2008) states that half of the patients with lower extremity ulcer presents a history of venous ulcer of 5 to 10 years and longer. Living with a chronic wound is accompanied with long-term physical and psychological distress. Wound pain is frequently experienced and it is an overlooked factor in wound care.

A study by Hofman *et al* (1997) shows that 69% of patients find their pain as the worst aspect of having an ulcer. Many patients consider pain reduction a highest priority in chronic-wounds treatment (Lindholm *et al* 1993, Coutts P *et al* 2008). Both patients and practitioners rank pain at dressing change and cleansing related procedures as the most unpleasant one (EWMA 2002).

Wound-related pain can have a negative impact on patients' quality of life (QoL) and affects healing processes including oxygenation and poor infection control (White R 2008, Coutts P *et al* 2008).

During the recent years wound-related pain has gained more interest among researchers and healthcare professionals. Several wound-pain related guidelines have been developed (European Wound Management Association (EWMA) 2002, Coloplast 2008, World Union of Wound Healing Societies (WUWHS) 2004). Still, some researchers suggest that wound-related pain is inadequately treated, underdiagnosed or even neglected (Krasner D. 2016, Benbow M. 2015, Woo K. 2008, Gräni 2014).



## **2 BACKGROUND**

### **2.1 Definition of the word wound and nomenclature of chronic wounds**

Encyclopaedia Britannica defines the word wound as "a break in the continuity of any bodily tissue due to violence, where violence is understood to encompass any action of external agency, including, for example, surgery". Pursuing this further, in the Greek language a word used for wound - "trauma" refers to skin injury followed by some external force. In the English language, the word "trauma" can be defined also as an emotional shock.

The medical literature often divides wounds into acute and chronic. The skin lesions are classified as acute or chronic with regards to their aetiology. Acute wounds are mostly caused by external factors, chronic wounds have more internal nature (Hermans 2010).

The Latin terminology uses two words "vulnus" and "ulcus" to describe different wounds. "Vulnus" means an acute damage to a continuity of bodily tissues caused by external factors such as surgery or bullet, while a word "ulcus" is used to describe chronic wounds (Juutilainen & Hietanen 2012). Also, English literature commonly uses a word "ulcer" as a synonym of a chronic wound.

Another widely accepted definition divides wounds into chronic and acute regarding the time of their healing. According to this definition, the acute wound should show signs of healing within four weeks. Chronic wounds do not show evidence of healing for more than four weeks and remain in one phase of healing for a long period (Swezey 2015). Whereas Juutilainen and Hietanen (2012) do not fully agree with this definition stressing that some acute wounds may require over four-week time to heal.

## **2.2 Aetiology of chronic wounds**

Chronic wounds fall into four categories: pressure ulcers, diabetic ulcers, venous ulcers and arterial insufficiency ulcers (Wound Healing Society 2007). They differ by their aetiology and causative factors. As mentioned before, the underlying cause of chronic wounds has more internal nature comparing to acute wounds. However, some chronic wounds may have mixed aetiology. For example, pressure ulcers are a result of shear combined with pressure (Krasner 2016).

The most common causes of ulcers include diseases such as vascular disease, diabetes mellitus, rheumatoid disease (Peate *et al*, 2015). Both Krasner (2016) and Peate *et al* (2015) list factors such as smoking, obesity, age, certain medications, hypertension or arteriosclerosis which can impair the healing process and make patients vulnerable to develop chronic wound.

### **2.2.1 Pressure ulcers**

The major cause of pressure ulcers is pressure. The process of pressure ulcer formation consists of several factors such as intensity of pressure, duration of pressure and tissue tolerance. Pressure ulcers result from excessive pressure on tissues.

A conceptual schema of aetiology of pressure ulcers by Braden and Bergstrom (1987) adapted by Krasner (2016) presents factors that contribute to pressure and tissue tolerance. Factors contributing to pressure consist of a decrease in mobility, activity and sensory perception.

Tissue tolerance describes the condition of the skin and underlying structures. The most prone sites for developing pressure sores are those above skeletal structures such as sacrum, buttocks, heels. Several extrinsic factors such as increased moisture, friction, and shear impair tissue vulnerability and makes it more prone to damage.

A healthy person with unaffected sensory perception can change position whenever feels discomfort resulting from capillary closure and tissue hypoxia. Unfortunately, cer-

tain processes such as sedation, spinal cord injury affect an individual's ability to respond to the discomfort.

Intensive and prolonged pressure on capillaries causes their collapse and tissue anoxia. However, even a low-intensity pressure applied over a long period of time affect tissues just as high-load pressure over a short period of time.

### **2.2.2 Arterial and Venous ulcers.**

The most causative factor for developing arterial ulcers is the atherosclerotic disease. Others, but much less common causes of arterial ulcers, are Buerger disease, sickle cell disease and vasculitis. The arterial insufficiency and arterial ulcer can be developed by persons with diabetes, hyperlipidaemia or hypertension. Smoking is also a risk factor for arterial ulcers. Atherosclerotic disease contributes to hardening and narrowing of the vessels which further compromises blood flow. Atherosclerosis usually progresses asymptotically causing an insufficient blood distribution into the tissues. Chronic ischemia can lead to a sudden onset of tissue necrosis and gangrene (Krasner 2016).

Venous ulcers are a result of insufficiency of the lower extremity venous system: high venous pressure, venous hypertension, obstruction in veins and failure of calf muscle pump. Normally functioning veins provide one direction blood flow towards the heart. The unidirectional blood flow is supported by valves, venous walls and calf muscle pump that prevent backflow of blood to superficial venous system. Impairment of valve function and decreased calf pump function result in increased pressure in venous system. Failure of normal blood flow in lower extremity damages superficial venous system causing congestion and dissention. Prolonged venous hypertension results in damage to skin and soft tissues causing ulceration.

### **2.2.3 Diabetic leg ulcers**

The risk of developing leg ulcers due to diabetes is 12-25% (Szewczyk *et al.* 2012). The most common causative factors contributing for development of diabetic wound include neuropathy, peripheral arterial disease and musculoskeletal abnormalities. Diabetic leg ulcers are the most common complication of diabetes. Approximately 78% of all diabetic foot ulcers are caused by peripheral neuropathy. A diabetic person with poorly controlled glucose levels is more likely to develop impaired nerve conduction. Other conditions contributing to development of neuropathy nerve compression, trauma, fractures, acquired immunodeficiency syndrome (AIDS), rheumatoid arthritis, lupus erythematosus, radiation and cold exposure. Abnormalities in foot anatomy are very common in diabetic population and with those with peripheral neuropathy (Krasner 2016).

## **2.3 Prevalence of chronic wounds**

The research conducted by Guest *et al* (2012) shows that the mean age of patients' suffering from chronic wounds in the UK was 69.0 years and 45% were male. Also, it is estimated that 60-70% of all pressure ulcers occurs in the elderly population over 65 years old (Szewczyk *et al.* 2012). A study conducted by Woo K *et al* estimates that 26% of patients in a home care setting and hospital have a pressure ulcer. It is estimated that 2% to 3% people with diabetes develop ulcer annually. A risk for developing neuropathic wound for diabetic patients is 11-25% (Woo K *et al* 2008).

Also, gender has a big impact on developing a lower extremity wound. The risk for venous ulcer in women is as twice higher than in men. In arterial ulcers, the incidence was four times higher in men, while after the age of 70 the incidence was equally high in both genders.

In Krasner (2016) from 1% to 3% and more of the population of developed and developing countries is suffering from venous ulcers. The prevalence of pressure ulcers in the United States in long-term care facilities varied from 8.2% to 32.2% in nursing homes,

2.9% to 19.1% in home care setting. The prevalence for pressure sore paediatric patients with diagnoses of cerebral palsy, spinal cord injury and myelodysplasia was estimated from 0.47 % to 75% .

The literature review by Graves N & Zheng H (2014) shows a big variation in prevalence of chronic wounds worldwide. The estimated prevalence worldwide for pressure ulcers varies from 1.1% to 26.7% in the hospital setting, 6% to 29% in the community setting, 7.6% to 53.2% in the nursing home setting. In the case of diabetic ulcers, the prevalence varied from 1.2% to 20.4% in the hospital setting and from 0.02% to 10% in the communities. The prevalence for lower extremity wounds varied from 0.05% to 1% in the community, 2.5% in the nursing home setting and 0.05% in hospital setting for venous ulcers and 0.1% in community setting for arterial ulcers.

The economic burden of chronic wounds is associated with the time which chronic wounds require to heal, materials, hospitalization and nursing time. A study of patients suffering from lower extremity ulcers showed that half of them had leg ulcer history from 5 to 10 years and longer (Woo K. *et al* 2008).

Currently, 2-5 % of total healthcare expenditure in developed countries is spent on management of wounds (Järbrink *et al* 2017; Graves & Zheng 2014). Approximately 2.5 million Americans suffer from venous ulcers. The annual cost of management of these wounds varies from \$2.5 to \$3.5 billion. The annual cost for pressure ulcers in 2011 was estimated at \$9.1 to \$11.6 billion. Data collected by the National Health Service (NHS) estimates that 2.2 million wounds were treated in the UK during years 2012-2013. Approximately £5.3 billion annually was spent on the treatment of these wound and associated comorbidities.

It is estimated that 11 000 - 15 000 people in Finland suffer from venous ulcers. Venous ulcers are the most common among Finnish population as they make up around 70-90% of all lower extremity ulcers. In Helsinki alone, chronic wounds cost approximately 7-14 million euros annually (Korhonen & Lepäntalo 2012).

## **2.4 Is wound pain common?**

Some researchers suggest that wound pain has been neglected due to the myth that chronic wounds do not cause pain (Krasner 2016). However, the literature shows a high prevalence of pain among patients with chronic wounds.

Price *et al* (2008) reported that 40% of patients perceived that pain during dressing changes were the worst part of living with the wound. Woo (2008) has reported 80% prevalence of wound-related pain. Estimated pain prevalence among patients with leg ulcers varies from 28% to 93% (VanDenKerkhof *et al* 2013). In a study conducted by Dallam *et al* (1995) 68% of 132 participants with pressure ulcers reported a wound pain (Krasner 2016).

The study conducted by Domingues *et al* (2016) reported 69% pain prevalence among 200 participants with no correlation to age, number of wounds and wound duration. Also, the study found the association between wound aetiology and the intensity of pain during dressing change. Patients with arterial ulcers complained of moderate pain (37.5%) and the worst imaginable pain (50%); while those with venous ulcer pain reported mild or moderate (28.2%) and severe pain (17.9%).

## **2.5 Anatomy of wound-related pain.**

“[Pain is] Whatever the experiencing person says it is and exists whenever he says it does”. This is the first definition of pain developed by McCaffery in 1972. Later, in 1994 the International Association for the Study of Pain (IASP) along with the American Pain Society (APS) defined pain as “An unpleasant sensory and emotional experience associated with actual or potential tissue damage, or described in terms of such damage”.

Pain became considered the fifth vital sign as an indicator of dysfunction or disease and a sign of infection or inflammation in terms of wound care. In chronic wounds, the pain

can be linked to the aetiology of the wound (e.g. lipodermatosclerosis in venous ulcers or neuropathy) and local factors such as ischaemia, infection, dryness or extreme amount of exudate, oedema and maceration (EWMA 2004).

Pain in peripheral arterial occlusive disease (PAOD) results from intermittent claudication caused by restricted arterial blood flow that is not strong enough to meet demands of the calf muscle. Intermittent claudication means reproducible leg pain or cramping in the calf region during activity and is relieved during rest. Venous insufficiency can be associated with an aching or deep muscle pain. The pain in diabetic ulceration may result from neuropathy, osteomyelitis or Charcot's foot. The underlying factor for pressure ulcer pain is not well understood but may be associated with friction, peri-wound irritation, moisture imbalance related to incontinence (Bechert 2009).

Pain can be classified as a neuropathic or nociceptive. Nociceptive pain may be a result of a tissue damage. Nociceptors or pain receptors are located at the end of a sensory neurons which respond to external stimuli by sending pain signals via the spinal cord and the brain. In chronic wounds, nociceptive type of pain usually is associate with acute or chronic inflammation. As prolonged inflammation is characteristic for chronic wounds many patients may experience higher sensitivity in the wound and peri-wound skin. Nociceptive pain or acute pain is a normal physiological reaction to painful stimulus. This pain is time limited and resolves when the cause of pain ends.

Sometimes the normal pain responses at the site of the injury outlast their usefulness causing increased sensitivity to painful stimuli (hyperalgesia) or react on stimuli that normally does not cause a pain (allodynia) (Krasner 2016, WUWHS 2003). Hyperalgesia means that noxious stimulation becomes more painful than usually. It results from oversensitivity of nerves followed by acute tissue injury or ongoing inflammatory mediators. A term allodynia refers to a normally nonpainful stimulus that becomes painful.

Neuropathic pain is typically associated with malfunction of nerves due to trauma, infection, metabolic disorder or cancer. Certain diseases such as postherpetic neuralgia, diabetic neuropathy and trigeminal neuralgia. Neuropathic pain is the major cause for developing chronic pain. This type of pain is often described as burning, shooting or

stinging sensation (Woo 2012). There may also be so-called negative symptoms such as a sensory deficit (Gräni *et al* 2014).

IASP (1994) has subclassified pain as operative, procedural, incident and background. Operative procedural pain refers to the manipulation of tissue e.g. debridement. Procedural pain refers to interventions such as dressing changes or cleansing. Incident pain occurs during movement-related activities involving friction, dressing slippage or coughing. Background pain usually is caused by wound aetiology, for example, ischaemia or infection (Krasner 2016).

Inappropriate dressing selection can cause additional trauma to sensitive peri-wound skin during its removal. Additionally, wound cleansing materials such as forceps, gauze, cleaning solutions show an increased evidence of pain. A survey conducted by EWMA (2002) found that the most important factors contributing to pain are dried out and adherent dressings followed by cleansing and fear of hurting, previous negative experience at dressing change and a use of a packed gauze. Gauze was also ranked as the product that mostly causes the pain, followed by knitted viscose, film dressings, paraffin tulle and low adherent dressings.

Some patients may experience a mixed form of pain. Nociceptive / Neuropathic pain has been described by Krasner as a mixture of nociceptive and neuropathic factors due to primary malfunction of nervous system where a nerve injury triggers inflammatory responses characteristic for nociceptive pain. Krasner reports that nociceptive/neuropathic pain has been often present in venous ulcers.

Gräni *et al* 2014 noticed that some patients may suffer not only from pain but also develop autonomic reflex responses such as racing pulse and sweating caused by fear from doctor's visit and dressing change. This type of pain is called a psychogenic pain and is triggered by anxiety and stress.



### **2.5.1 Gate Control Theory of Pain**

The Gate Control Theory was proposed by Ronald Melzack and Patrick David Wall P.D. (1962, 1965). This theory asserts that the perception of physical pain does not simply come from activation of nociceptors but is modulated by the interaction between pain transmitting and non-pain transmitting nerves. The theory explains how activation of non-pain transmitting nerves can interfere with signals from pain fibers and inhibit an individual's perception of pain.

## **2.6 Consequences of wound pain**

Wound pain negatively affects patients' psychological and physical well-being. Untreated wound pain is associated with poor infection control and decreased oxygenation in the wound. Pain is associated with increased tissue hypoxia that impairs wound healing.

Increased epinephrine levels lead to vasoconstriction and deficit of blood supply in extremities. An increased tissue hypoxia inhibits activation of leukocytes what may lead to wound infection (Krasner 2016). Moreover, pain at dressing removal can disable wound debridement and cleansing. Bowers K. *et al* (2009) cited that poorly managed post-operative pain decreases respiratory movements, delays mobilization, increases activity in the sympathetic nervous system and affects hormonal and metabolic activity.

Health professionals believe that pain is the major factor contributing to mood disorders experienced by patients with acute and chronic wounds (Upton *et al* 2012). Choiniere (2001) established a link between pain management, psychological resilience and recovery, stating that prolonged experience of discomfort decreases psychological resilience and increases levels of stress (Bowers *et al* 2009). Furthermore, the association between pain, stress and slowed wound healing was described by Upton and Solowej (2012). Patients with painful chronic wounds are prone to develop mood disorders, sleeping problems, fatigue and fear of future pain. Studies show that some patients may avoid physical activity and even retire from social life.

## **2.7 Assessment and management of wound related pain.**

The differential causes, intrinsic and external factors contributing to wound pain require an individualized pain management plan for each patient. A potential pain cause should be addressed and appropriate treatment regimen undertaken. For example, infected skin ulcers will require appropriate antibiotic therapy and potential antibiotic resistance is to be considered (Gräni *et al* 2014). However, pain associated with chronic wounds may be influenced by factors other than inflammation or infection.

### **2.7.1 Assessment of wound-related pain.**

A guide of World Union of Wound Healing Societies' educational initiative (2004) recommends a use of layered approach that would limit pain and discomfort at dressing related procedures. An initial assessment of pain should include patient's pain anamnesis involving background, procedural, incident and operative pain. WUWHS also suggest a use of a body map diagram to localize a site of pain. This assessment should use a holistic approach and explore an impact of pain on daily routines and psychological well-being of a patient.

On-going assessment should measure intensity of pain before, during and after the procedure by using agreed pain scales. The assessment should be well documented and re-considered during future dressing change procedures. Changes in the intensity of pain may give clues about healing progress or inflammation (Formankiewicz, 2014). Krasner suggest a use of nonverbal signs of pain and body language such as moaning, loss of appetite, decreased activity.

In the international survey conducted by the EWMA, eight out of eleven countries stated that verbal reporting was most effecting in identifying the pain. Finland ranked body language as the most important factor of pain assessment.

Frequently a group of nonverbal and cognitive impairment patients are most prone to be inadequately and poorly assessed. Krasner reports that even 40% to 60% of residents in long-term facilities do not use prescribed analgesics. Assessment of pain in the elderly can be conducted by using two observational pain intensity scales which have been developed: The Pain Assessment in Advanced Dementia (PAINAD) and Checklist of Nonverbal Pain Indicators (CNPI).

### **2.7.2 Pharmacological management**

Pharmacological pain management is based on The World Health Organization which has developed three-step ladder for managing cancer pain (see Appendix 4). First step are simple analgesics such as paracetamol or NSAID's. For uncontrolled pain, weak opioids such as codeine or tramadol can be added or used alone. A third step, based on a full evaluation of the previous strategies used, is adding a stronger opioid. Treatment of operative pain can consist of local neural blockade, spinal analgesia, general anaesthesia or the use of mixed nitrous oxide and oxygen should be considered (Entonox).

However, it is important to anticipate potential adverse effects of analgesics. For example, certain analgesic must be used cautiously in patients taking anticoagulants to prevent interactions. Impaired renal or hepatic function may affect the metabolism of pain medication. Consideration must be given to the side effects of opioids as they may cause constipation, nausea, dizziness or vertigo, as well as sleepiness and drowsiness, vomiting, dry skin, itching or pruritus and sedation. All of them occurred more frequently with opioids than with placebo (Acton 2007). A local use rather than systemic pain treatment can minimize the risk of side effects. Strong evidence is available to support the use of topical analgesics such as EMLA cream (lidocaine and prilocaine) prior to the debridement of venous leg ulcers (Woo *et al* 2008). Ibuprofen releasing foam dressings has showed efficiency in persistent wound pain between dressing changes and pain on dressing removal.

The WUWHS (2004) stated that an appropriate interval between administration of medication and procedure is one to two hours whenever paracetamol or ibuprofen is being used. EWMA (2002) suggested that short-acting opioids (eg. Codeine) should be given up to one hour to take effect before starting wound-related procedure.

Neuropathic pain due to its severity and resistance to analgesics may be difficult to relieve. Treatment of neuropathic pain often requires a use of non-analgesic agents such as gabapentin or pregabalin. Tricyclic antidepressants, serotonin-norepinephrine reuptake inhibitor such as venlafaxine or selective serotonin reuptake inhibitors (SSRIs) can be effective for treatment of neuropathic pain. Moreover, use of topical capsaicin, mild and strong opioids has been also proven to be efficient in neuropathic pain management (Krasner 2016)

### **2.7.3 Non-pharmacological management.**

Modern dressings with an atraumatic and nonadherent wound contact layer, such as silicone, prevent skin damage and trauma to soft tissues during dressing removal and minimize pain at dressing changes. Silicone dressings consist of chains of hydrophobic polymers with alternate molecules of silicone and oxygen. In comparison to other adhesives, the silicone products have a lower surface tension combined with a more extensive contact interface. Silicone-coated dressings do not adhere to a moist wound bed (Gräni *et al* 2014). Therefore, silicone dressings remain a good solution for patients with anticipatory pain and prone to develop peri-wound trauma. Also, ringer solution containing dressings has also proven efficacy in decreasing wound pain (Colegrave 2016).

The peri-wound area can become painful due to maceration, excoriation, contact dermatitis arising from dressing materials and epidermal stripping during removal of adhesive dressings (Bowers 2009). Furthermore, frequency of dressing change and right selection of dressings with appropriate fluid handling capacity and size should be considered to prevent skin maceration, tissue erosion and pain.

It has been proven that anxiety and anticipation may amplify the sensation of pain. Literature shows some efficiency of relaxation, hypnotic and autogenic techniques, bio-feedback and relieving pain by distraction. During dressing changes in patients with burns, hypnosis has shown more efficiency than relaxation techniques. Certain psychological therapies such as cognitive behavioural therapy (CBT) are widely used for chronic/neuropathic pain. Moreover, transcutaneous electrical nerve stimulation (TENS) has been used for treatment of different types of chronic pain. TENS machine stimulates selectively non-nociceptive fibers with electrodes.

A consensus document published by WUWHS, Minimising Pain at Wound Dressing-Related Procedures in 2004 suggests following measures for effective pain management:

Choose an appropriate non-stressful environment.

Close windows, turn off mobile phones, etc;

Explain to the patient in simple terms what will be done and the method that will be used;

Assess the need for skilled or unskilled assistance, such as someone to simply hold the patient's hand;

Be thoughtful in positioning the patient to minimise discomfort and avoid unnecessary contact or exposure;

Avoid prolonged exposure of the wound, eg waiting for specialist advice;

Avoid any unnecessary stimulus to the wound – handle wounds gently, being aware that any slight touch can cause pain

Involve the patient throughout – frequent verbal checks and use of pain tools offer real-time feedback;

Consider preventative analgesia.

## **3 THEORETICAL FRAMEWORK**

### **3.1 Wound pain models**

Wound pain models can be used as a tool in guiding healthcare professionals through a logical and systematic assessment of the wound so that the interventions can be selected upon the type and the source of the wound. Several wound pain models have been developed, such as The Chronic Wound Pain Experience model developed by Diane Krasner in 1995. The model encompasses three types of pain and provides actions for appropriate pain control strategies for each pain. Another more recent wound-associated pain model developed by Kevin Woo and Gary Sibbald in 2008 approaches wound-related pain regarding its aetiology, underlying wound cause, local wound care and patient-related concerns such as anxiety or depression. Both models can be used as guidelines for treating painful chronic wounds, providing strategies for pain control based on the type and cause of the pain (Krasner, 2016).

#### **3.1.1 The Chronic Wound Pain Experience model**

The Chronic Wound Pain Experience (CWPE) model was developed by Diane Krasner in 1995. The model encompasses three types of pain: noncyclical acute wound pain caused by a single event such as sharp debridement; cyclic acute wound pain resulting from repeating treatments and chronic pain. The CWPE model provides recommendation for each type of pain. Also, the model can be indicated for those patients who are unable to recognize their pain. The scheme of the model was developed for different type of wound pain:

1. Noncyclical acute wound pain, for example during sharp debridement or drain removal;
2. Cyclic acute wound pain; acute wound pain that occurs at daily dressing changes or at repositioning;
3. Chronic wound pain; it is a continuous pain without wound manipulation.

### **3.1.2 The Wound Associated Pain (WAP) model**

The WAP model illustrates three key components contributing to wound pain such as:

1. Underlying cause of the wound and its potential relation with the pain;
2. Local wound care factors; for example, recurring trauma caused by adhesives, infection or moisture imbalance in wound bed;
3. Patient centered concerns; impact on quality of life, anxiety, involvement in treatment;

## **3.2 The Wound Pain Management Model**

The theoretical framework supporting this study is The Coloplast Wound Pain Management Model© (WPM) developed by Karsten Fogh, *et al.* (2008). Despite the similarities between the mentioned wound pain models, the WPM model was chosen due to its detailed approach to wound pain management. Secondly, the model combines approaches from two other models, provides management strategies for three types of pain and looks into factors contributing to pain.

The model consists of four levels for wound pain management can be used as a tool for establishing care plan for patients suffering from wound associated pain. The author recommends assessing and treating both the wound and the pain at the same time. First level of pain management lays in Wound Assessment - underlying cause of wound pain must be assessed and diagnosed. The model consists of prevention and management strategies for each type of chronic wound. For example, in painful venous leg ulcer, a use compression therapy and/or leg elevation can be applied as a part of pain management. Local Wound Management should be applied to treat factors that may intensify the wound pain, e.g. infection, oedema, exudate, critical colonization. Strategies for treatment and prevention should consist of appropriate dressing selection, compression therapy and elevation. Pain Assessment should be performed in regard to location, dura-

tion and intensity of the wound pain. In order to select a suitable pharmacological management, the type of pain should be diagnosed. Event-related pain, for example at dressing change or during debridement, should be addressed. Wound-related pain is often linked with poor quality of life. Therefore, the impact of the wound pain on the Quality of Life (QoL) and Activities of Daily Living (ADLs) should be considered. The fourth level of the Wound Pain Management model assumes two co-existing types of pain: temporary or acute pain related to wound care procedures such as dressing changes and persistent type of pain which can be experienced between dressing changes and which is caused without any kind of wound manipulation. The model considers two types of local management - non-active or/and active. Non-active pain management uses non-pharmacological strategies such as selection of dressings. An active pain relief considers topical anaesthetic or systemic pain medication for acute pain at wound debridement. The pharmacological approach should be applied according to the type of the pain. In nociceptive pain the WHO analgesic ladder can be used. A pain described as neuropathic may require antidepressants or anticonvulsants. The mixed type of pain may require a combination therapy.

#### **4 STUDY OBJECTIVES AND RESEARCH QUESTIONS**

The purpose of this study is to identify factors that contribute to wound pain and to explore strategies for efficient management of wound-related pain at dressing changes.

The aim of this thesis is to look for answers to following questions: what are the factors contributing to wound pain at dressing change? What methods can be used when treating wound related pain at dressing related procedures?



## **5 METHODOLOGY**

### **5.1 Sources of data**

Articles used in this study were sourced from electronic databases such as Academic Search Elite (EBSCO), Science Direct and Google Scholar. Main search phrases used for this research were ‘wounds or ulcers’ AND ‘pain’ OR ‘pain management’, ‘wound related pain’ AND ‘pain management’, ‘dressing change’ and ‘debridement’.

### **5.2 Inclusion criteria**

Before the collection of the data the author has established initial inclusion criteria including;

1. The year of publication of the study should not be older than 10 years;
2. Only articles written in English language;
3. The articles should be a full text and free of charge;
4. Articles with most relevant title;

After the pre-selection and reading the abstracts of collected articles the more specific inclusion criteria were applied;

6. The content of the article answers at least one research question;
7. The study is related and applicable to the nursing practice;
8. The focus of articles is pain / pain management in chronic wounds in adults;
9. Only original research articles;

### **5.3 The search process**

The process of establishing the data for this study used several search engines such as Academic Search Elite (EBSCO), Sage, Pubmed, Science Direct, Google Scholar. A search was performed on 8<sup>th</sup> August 2017 for EBSCO, Sage and Google Scholar. The

second search was conducted on 4<sup>th</sup> September 2017 for Science Direct and PubMed and on 28<sup>th</sup> October 2017 for EBSCO and Science Direct database.

Firstly, titles and abstracts were reviewed by the author. For studies that met the eligibility criteria, full-text was read. The author has also examined the reference list for more relevant studies. The author excluded studies that contained only abstract or their content were restricted, neither repeating studies were taken into consideration during the search process. For all search filters, time gap 2007-2017, full free text was applied. Details of the search were reported in the table below. 12 out of 45 collected articles were chosen after reading their full content and references, as well as after applying the specific inclusion criteria. After conducting the third search on the 28th October 2017 using EBSCO and Science Directed the author decided to add 3 more articles.

*Table 1. The search process: summary of databases, hits and saved articles.*

DATABASE	KEY WORDS	NUMBER OF HITS	SAVED ARTICLES
EBSCO	“ulcer or wound” [TITLE]AND “pain” [TITLE]	42	15
	‘ulcer or chronic wound” [TITLE] AND “pain” [TITLE ]	16	
	‘pain”, “dressing change” AND “debridement”	3	
PubMed	“wound or ulcer” [TITLE] AND “pain” [TITLE]	80	

	“wound” [TITLE] AND “pain” [TITLE]	54	12
	“ulcer or chronic wound” [TITLE] AND “pain” [TITLE]	29	
SAGE	“wound”[TITLE] AND “pain” [TITLE]	5	1
Google Scholar	"wound-related pain", "pain management”	558	15
Science Direct	“ulcer” [TITLE] AND “pain” [TITLE]	28	5
	“pain” [TITLE] AND “dressing change”	7	
	“wound related pain” [ABSTRACT, TITLE, KEYWORDS]	293	
<b>Number of saved articles in total = 48</b> <b>Number of articles chosen for this study after reading the full content and applying inclusion criteria = 12</b>			

## 5.4 Articles chosen from electronic sources for this study

Table 2. Articles chosen for this study

Author/s and Title	Journal name, date, volume, issue and pages	Aim of the study	Source and study type
1. Butcher M, White R (2014) Remedial action in the management of wound-related pain	Nursing Standard, 2014 Vol 28, No 46, pp 51-60.	What are the factors influenced by pain at wound dressing change.	EBSCO, Delphi study
2. Price P. <i>et al</i> (2008) Dressing-related pain in patients with chronic wounds: an international patient perspective	International Wound Journal 2008;5 pp 159–171	To assess patients' perception of wound pain at wound dressing change.	Google Scholar, cross-sectional international survey
3. Gottrup F. <i>et al</i> (2008) Reducing wound pain in venous leg ulcers with Biatain Ibu: A randomized, controlled double-blind clinical investigation on the performance and safety	Wound Repairment and Regeneration, 2008, 16 pp 615–625.	Comparing two moist wound healing dressings	EBSCO, A multinational and multicenter randomized double-blind clinical investigation
4. Kevin Y Woo (2015) Unravelling nocebo effect: the mediating effect of anxiety between anticipation and pain at wound dressing change	Journal of Clinical Nursing, 2015, 24, pp 1975–1984	Relationship of anticipation, anxiety and pain perception at dressing change in patients with chronic wounds.	PubMed, cross-sectional study with repeated measures
5. White R. (2008) A multinational survey of the assessment of pain when removing dressings	Wounds UK, 2008, Vol 4, No 1	Assessment of dressings with soft silicone adhesive technology on wound pain	Multinational survey

6. Cutting KF <i>et al</i> Wound infection, dressings and pain, is there a relationship in the chronic wound?	International Wound Journal, May 2012, pp 1-10	Link between infected wounds and increased pain and impact of dressings/ antiseptics on wound pain.	PubMed, Delphi study
7. Maida M. (2017) Topical Medical Cannabis: A New Treatment for Wound Pain: Three Cases of Pyoderma Gangrenosum	Journal of Pain and Symptom Management, Vol. 54 No. 5 November 2017	Measuring pain relieving effect of Topical Medical Cannabis in three patients with pyoderma gangrenosum	Ebsco, case study
8. Bell C, McCarthy G. (2010) The assessment and treatment of wound pain at dressing change.	Br J Nurs 2010;19:S4–10.	To investigate nurses' knowledge about dressing change and wound pain	A quantitative pilot study snowballed from <b>Cutting KF <i>et al</i> Wound infection, dressings and pain, is there a relationship in the chronic wound?</b>
9 McGinnis E (2014) <i>et al</i> Pressure ulcer related pain in community populations: a prevalence survey	BMC Nursing vol 13 No 16	To estimate the prevalence of pressure area related pain within a community population	cross-sectional survey PubMed
10. Sibbald G. <i>et al</i> Reduction of bacterial burden and pain in chronic wounds using a new polyhexamethylene biguanide antimicrobial foam dressing: clinical trial results	Wound Healing Southern Africa, 2012 Volume 5 No 1 pp 31-36	Effectiveness of a polyhexamethylene biguanide (PHMB) foam dressing for the treatment of superficial bacterial burden, wound-associated pain, and reduction in wound size.	Google Scholar, A randomized controlled trial
11. Renner R., <i>et al</i> Association of Pain Level, Health and Wound Status in Patients with Chronic Leg Ulcers	Acta Derm Venereol 2014; 94: 50–53	Evaluate the level of suffering endured by patients because of their ulcer-related pain, and to evaluate whether and how this pain is treated	PubMed, Clinical report

12. Schaffner <i>et al.</i> A New Tool for Real-Time Pain Assessment in Experimental and Clinical Environments	Plos One, 2012 Vol 7 No 11 pp. 1-7	Checking the accuracy of Painmouse device in measuring pain levels in leg ulcer via hand grip force.	EBSCO, Clinical Trial
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## 5.5 Content analysis

The analysis was supported and guided by the research questions and theoretical framework chosen for this study - The Wound Pain Management Model (WPM). Nevertheless, the research uses inductive approach of analyzing data and aims to find new solutions and ideas for managing wound-related pain at dressing change. The inductive approach means that an author analyses data through reading several times contents of the search findings. The approach is guided by evaluation objectives. Although the findings are influenced by the evaluation objectives, they still emerge from raw data, not from bias or theories (Thomas 2006).

The analysis of the collected studies was conducted through reading and summarizing the content of the articles. The author pointed out the most relevant findings and gathered into categories. The findings were organized under two main study questions.

## 5.6 Ethical considerations

This research was written under Arcada University of Applied Science writing guidelines. All data used for this study were referenced according to Harvard referencing style to avoid copy right violation. The author has tried to remain objective and avoid bias and personal beliefs.

## **6 RESULTS**

### **6.1 Factors contributing to wound pain at dressing change.**

#### **6.1.1 Wound care procedures**

Wound cleansing procedures such as wound irrigation, dressing removal and wound handling/touching were pointed to be most painful (Bell & McCarthy 2010; Woo 2015; Price 2008). Butcher & White noted poor choice of dressing initiated either by health care professional or a patient to be the most common cause of wound pain. The survey conducted among nurses by Bell & McCarthy (2010) ranked dried-out dressings and adhesives as the main factor contributing to pain at dressing change. Cutting *et al* 2015 also reported that dressings such as adhesives, gauze, tulle and negative pressure wound therapy (NPWT) are linked to greater pain. Furthermore, antimicrobial dressings (silver dressings and iodine dressings) were linked to cause more pain (Price *et al* 2008).

#### **6.1.2 Type of ulceration**

Wound-related pain is often related to wound aetiology. Patients with venous, arterial and mixed ulcers may experience greater pain than patients with other types of wounds. Patients with venous ulceration rated their pain at dressing change to be more extreme. Data gathered by Price *et al* 2008 indicates that patients with leg ulcers experience as big pain intensity as patients with burns. In the study by McGinnis, 75.6% of patients with pressure ulcers reported pain. Moreover, pain intensity reported by patients with pressure ulcers was not related to the severity or stage of the ulcer.

#### **6.1.3 Changes in wound status**

Two studies associated infection as the main cause of wound pain. Patients with infected wound experience more pain than those without wound infection. Results from Butcher & White ranked infection as the main reason for pain at dressing change. Cut-

ting *et al* agreed that sudden onset of pain or change in its intensity is more likely to be linked to infection.

#### **6.1.4 Insufficient analgesia**

There has been a big discrepancy between data showing sufficiency of used analgesia among patients. In an international survey by Price *et al* the percentage of patients who were satisfied with their pain relief varied between 68% and 83%. While German based survey by Renner *et al* 2014 shows that 36% of patients rated their prescribed medication working moderately. Renner noted an underrepresentation of opioid analgesia used in pain management. The study showed a similar number of patients with VAS >5 and those with VAS <5 who were taking no or mild analgesia. Findings from Price *et al* show that 79% of patients who did not take any analgesia considered their pain relief ineffective. It has been noted that patients are concerned about side effects of their pain medication (Price *et al* 2008).

#### **6.1.5 Anxiety and fear**

A role of psychological aspect in wound care was measured by Woo (2015). The study shows that those participants who were anticipating pain reported greater pain at dressing changes. Moreover, patients who developed new wounds and those whose wounds have heavy exudate and necrotic tissues experience greater anxiety levels.

#### **6.1.6 Institutional factors**

Butcher & White and McGinnis *et al* noted a link between care setting and pain intensity. Patients treated in a primary/community setting were most likely to experience stronger pain (VAS 9-10) while those treated in hospital had the lowest VAS score (0-2). A higher proportion of neuropathic pain was also observed in the community in comparison to the hospital setting. (McGinnis *et al* 2014).



## **6.2 Strategies for relieving pain at dressing related procedures.**

### **6.2.1 Use of assessment tools and documentation**

The pain should be measured and managed before, during and after the dressing change. Cutting *et al* recommends that each patient has a personalised management plan. Also, any change in pain intensity or pain exacerbation should be documented. Healthcare professionals should reconsider dressing management whenever suspect dressing to cause pain. Results from Butcher & White showed that the most commonly used assessment tool was the Visual Analogue Scale (VAS) and less frequently the Wong-Baker Faces pain rating scale. In the survey by Bell & McCarthy monitoring and talking to patient was ranked as the most common strategy used by nurses while use of assessment tools and previous pain experience was ranked low. Moreover, a use of a force-recording assessment device called “Painmouse” has been proved to be an accurate assessment tool for patients with chronic wounds. This device would allow nurses to perform dressing changes without missing values and necessity assessing patient’s pain at the same time (Schaffner *et al* 2012).

### **6.2.2 Use of systemic analgesia**

The level of pain management satisfaction experienced by the patient is determined by the nurse’s level of knowledge and confidence in administering analgesia (Bell & McCarthy 2010). Results from Price *et al* (2008) show that 14.9% of patients would find a use of anaesthetics beneficial. Bell & McCarthy noted that giving prescribed analgesia was the most common strategy used by nurses during dressing changes. The successful pain management should follow the WHO analgesic ladder (Butcher & White 2014; Renner *et al* 2014). Patients with highest VAS scores (10) may require hospitalization, frequent dressing changes, opioid medication, administration of nitrous oxide (Entonox) and start of anxiolytic medication. Use of strong opioids is reserved for those patients with VAS score above 5, both in wound and peri-wound skin. Anxiolytic medication can be administered to patients with score above or below VAS 5. An-

xiolytic medication can be administered for treatment of background pain eight hours after dressing change for VAS >5. Anaesthetics such as nitrous oxide is indicated for VAS score over 7 with combination of other analgesics.

### **6.2.3 Use of local analgesia**

A case study by Maida and Corban (2017) proved topical medical cannabis (TMC) to be an effective pain relief in wound management. In two out of three cases, the pain reduction was greater than 30%. Moreover, the use of TMC allowed patients to decrease use of their oral analgesics. Also, use of dressings containing pain relieving agents was measured in two studies. The double-blind controlled study conducted by Gottrup *et al* (2008) proved ibuprofen containing foam to be more efficient pain relief than the comparator. The participants experienced pain relief on the first dressing change, with 74% of ibuprofen-group patients reporting decrease in pain comparing with 58% in control group. The study reported pain reduction on day 1-5 by 40% compared with 30% in control group. A decrease in pain reduction on day 43-47 was documented when ibuprofen containing foam was changed to the comparator dressing. A clinical trial by Sibbald *et al* (2011) on efficacy of the polyhexamethylene biguanide antimicrobial foam (PHMB foam) reported no pain at dressing change in 78.9% of participants comparing with 33.3% in control group during the second week. The similar difference continued through week 4, with 73.7% in PHMB group versus 38.1% in the control group. PHMB is an antimicrobial agent that is commonly used in production of baby wipes, cleaning solutions for contact lenses and swimming pool cleansers. Also, Cutting *et al* noted high efficiency of topical antimicrobial agents on wound pain due to reduction on bioburden.

### **6.2.4 Use of non-pharmacological management.**

Selecting a non-traumatic and pain-free dressing is crucial in wound pain management (Bell *et al* 2010, Cutting *et al* 2015). Health care professionals should reconsider dressing choice whenever there is a sudden onset of pain or increase in pain at dressing change (Cutting *et al* 2015). According to the survey by Price *et al*, antimicrobials are

the most popular dressing and most frequently used in type of dressing in Finland, Australia, Belgium, Canada, Spain, UK, Italy, Germany and USA.

The dressings reported causing less pain were silicone dressings, silver dressings, sheet hydrogel, PHMB and ibuprofen foam. On the contrary, the patient reported survey by Price ranked silver-containing dressings to cause more pain. The international survey by White (2008) reported reduced pain levels in patients who were treated with traditional adhesive dressing and then switched to modern silicone dressing. The results showed reduces VAS scores from 4.6-5.2 to 2.1- 2.2 at dressing changes. Two studies mentioned soaking old dried out dressings before their removal (Price *et al* 2008; Bell & McCarthy 2010). Although there is no evidence supporting this practice (Bell & McCarthy 2010). Patients participating in the survey by Price *et al* suggested that use of creams or gels, non-adhesives and local anaesthesia would be beneficial. Furthermore, patient involvement into wound care procedures can ease the pain. Patients asked what in their opinion would have a positive influence on wound care procedures wished their health care professionals to be gentle and careful. Some therapies such as distraction techniques, music therapy, touch therapy, visual stimulation, hypnosis, stress-reducing strategies, guided imagery behavioural and cognitive therapy can be beneficial for patients suffering from anticipatory pain. However, there is no evidence supporting the effectiveness of those methods (Woo 2015).

## 7 DISCUSSION

The aim of this study was to find factors contributing to pain in chronic wounds and strategies for pain management at dressing related procedures. Factors such as infection, inappropriate dressing choice, type of ulceration and insufficient analgesia had the most negative impact on pain control during dressing changes. An adequate pharmacological management both local and systemic is essential for pain relief. It has been recommended that patients will receive analgesia according to their pain intensity measured with assessment tools. Thus, systematic assessment and documentation are significant in establishing the management plan for wound pain. Pain documentation is therefore important as it may give important clues about the onset of the infection. Although none of the studies discussed pain assessment in individuals with cognitive decline and elderly, it has been suggested that monitoring facial expression and use of “Painmouse” device can be beneficial. However, there are some limitations for use of this device in patients with an impairment of motor skills or sensory function (Schaffner *et al* 2012)

The pharmacological management described in this study were consistent with the previous research and recommendations. What is surprising, the studies discussed mostly pain management for nociceptive pain. However, Butcher & White noted a use of anxiolytic medication at dressing change, management strategies for neuropathic pain were not mentioned.

Patients should be prescribed and administered pain medication accordingly to their pain intensity measured by pain assessment tools together with the WHO analgesic ladder. Butcher and White (2014) suggest measuring pain intensity before, during and after dressing change. Administration of strong opioids should start with VAS score above 5/10. A use of anaesthetics such as nitrous oxide along with other analgesics should be considered in patients with scores greater than 7. Use of anxiolytic medication is indicated for a management of pain above or below VAS 5 and for background pain for eight hours after the dressing change for pain scores higher than 5.

Multinational survey by Price *et al* (2008) reported a sufficient pharmacological management among participants. Insufficient pharmacological management has been docu-

mented in one study: clinical report by Renner *et al* noted an underrepresentation of opioid analgesia and low satisfaction among patients with their current pain medication. Pain undertreatment may be linked to barrier to assessment especially in elderly patients. Also, a study by Price reported that many patients are concerned about side effects of opioids. Nonetheless, use of strong opioids should be monitored and assessed carefully especially in elderly patients (Krasner 2016).

It was found that certain types of ulceration might be more painful than the others. This research has noted that patients with venous and arterial ulcers suffer experience most pain. In study on pressure ulcers by McGinnis showed that pain there is no relationship between ulcer stage and pain intensity and patients with. Pain management in this case may partly consists of a use of a compression therapy or leg elevation (Coloplast, 2008) Interestingly, two studies have noted a link between care setting and pain intensity. Patients in community setting tend to have greater pain levels than patients in the hospital. This might be due to lack a routine assessment of pain lack of access to medical records in home environment (McGinnis *et al* 2014).

Newest strategies for local pharmacological management have showed efficiency in pain management. In addition to systemic analgesia, use of local anaesthetic can improve pain relief. So far, an efficiency of topically administered ketamine, capsaicin, lidocaine, and ibuprofen and opioids such as morphine, diamorphine and methadone have been studied (Maida *et al* 2011). In this study, two articles evaluated effectiveness of topical analgesia; Ibuprofen foam and Topical Medical Cannabis (TMC). A clinical trial by Gottrup *et al* showed reduced pain intensity in patients treated with ibuprofen foam dressing. Also, the survey by Price *et al* listed ibuprofen foam as a dressing causing less pain while Cutting *et al* did not fully agree on pain relieving effect of ibuprofen foam. A case study by Maida *et al* proved TMC to be an effective topical pain relief for patients with pyoderma gangrenosum. Local pain management with lower risk for side effects and rapid onset on analgesic effect would be the great solution for patients with painful wounds.

The results indicate that despite development and evidence-based effectiveness of modern dressings, traditional- gauze type and adhesives are still frequently used. This may result

from reimbursement rules in different countries (EWMA 2002) and levels of knowledge about dressing properties among healthcare professionals (Bell & McCarthy 2010). Pain at dressing change due to inadequate dressing choice was discussed in five studies. The results suggest that nurses should increase their knowledge of wound dressings and evidence-based practice. Silicone dressings are still the best choice for management of painful wounds. Other dressings, such as PHMB, ibuprofen foam, hydrogels and silver containing dressings should also be considered. Nevertheless, the underlying cause of wound pain should be assessed always when choosing dressing regimen. For example, patients experiencing pain due to the onset of the infection may benefit from use antimicrobial dressings.

Pain management is a multidimensional process, nurses should not forget about the psychosocial aspect of wound care. Patients should have a possibility to talk about their expectations and fears. A study by Woo suggests that heavy leakage, necrotic tissue, malodor and recently developed wounds can contribute to raised anxiety. Nurses should be aware of that and help their patients to overcome potential anxiety and catastrophic thinking.

## **8 CONCLUSION**

Pain management is an essential part of wound care. Poor pain control interferes with wound care procedures. Pain has been linked to poor infection control and can affect healing processes. This study has highlighted several factors associated with wound pain such as onset infection, inappropriate dressing choice, insufficient analgesia, anxiety or wound type. It is essential for nurses to understand the causes of pain and provide appropriate interventions and assessment. This study managed to identify factors associated with wound pain and current and future strategies that may help nurses to provide comfort and pain relief to their patients. The methods for pain management presented in this study could be used in the treatment of other types of wounds. The literature used for this thesis mainly focuses on health care perspectives dominant in Western Countries. The future research could explore the role of cultural diversity for management and assessment of wound-related pain.

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## APPENDICES

### Appendix 1 : Presentation of Reviewed Articles

Author, year, title	Study design	Study aim	Characteristics of study subjects	Assessment tools
<b>Butcher M, White R (2014)</b> <i>Remedial action in the management of wound-related pain</i>	Delphi study	Identifying the main factors influenced by the presence of pain at wound dressing change.	Expert panel of 21 clinicians agreed to take part in the project and participated in the first round of the study, Seventeen clinicians participated in the second round of the study.	closed Delphi study was conducted, with expert panel members being blinded from each other to reduce bias.
<b>Price P. et al (2008)</b> <i>Dressing-related pain in patients with chronic wounds: an international patient perspective</i>	cross-sectional international survey	To assess patients' perception of wound pain	2018 patients (57% female) from 15 different countries with a mean age of 68_6 years	a cross-sectional, descriptive questionnaire design, providing predominantly quantitative data
<b>Gottrup F. et al (2008)</b> <i>Reducing wound pain in venous leg ulcers with Biatain Ibu: A randomized, controlled double-blind clinical investigation on the performance and safety</i>	A multinational and multicenter randomized double-blind clinical investigation	Comparing two moist wound healing dressings	122 patients with painful chronic venous leg ulcers of more than 8 weeks, two weeks compression therapy before the initiation.	Use of two dressings specially designed for doubleblind study to be anonymous with the use of top-films without any print.
<b>Kevin Y Woo (2015)</b> <i>Unravelling placebo effect: the mediating effect of anxiety between anticipation and pain at wound dressing change</i>	cross-sectional study with repeated measures	To examine the relationship of anticipation, anxiety and pain perception at dressing change in patients with chronic wounds.	96 patients with chronic wounds with average duration more than eight months required dressing change including removal of dressing, cleansing of the wound and reapplication of dressing at the time of study.	Data were collected using the Six-items State-Trait Anxiety Inventory (STAI-6), Numerical Rating Scale, and the Pressure Ulcer Scale for Healing (PUSH) tool
<b>White R. (2008) A</b>	Multinational	to assess the impact of	A total of 3,034	Patients being treated with

<i>multinational survey of the assessment of pain when removing dressings</i>	survey	dressings with soft silicone adhesive technology on the Intensity of wound-related trauma and pain	patients were involved in the survey with variety of wound types including leg ulcers (venous, arterial and mixed aetiologies), burns, skin tears, pressure ulcers and diabetic foot ulcers	a traditional adhesive-based dressing then switched to second treatment with Safetac technology dressings.
<b>Cutting KF, White RJ, Mahoney P. (2012) <i>Wound infection, dressings and pain, is there a relationship in the chronic wound?</i></b>	Delphi study	To highlight any correlation found between infected wounds and increased pain/sensitivity and to report on the impact of dressings/ antiseptics on the somatic and operative influences of wound infection associated pain.	21 internationally recognised multiprofessional respondents accepted the invitation	Multinational expert panel who respond to several 'rounds' of set questions or statements that are interspersed with controlled feedback.
<b>Schaffner N. et al (2012) <i>A New Tool for Real-Time Pain Assessment in Experimental and Clinical Environments</i></b>	Clinical investigation	Testing a reliability of pain assessment by squeezing a pressure sensitive device	Sixteen healthy, right-handed male and Thirteen patients with painful leg ulcers	Use of Painmouse device, Visual Analog Scale (VAS)
<b>Bell C, McCarthy G. <i>The assessment and treatment of wound pain at dressing change.</i> Br J Nurs 2010;19:S4–10.</b>	A quantitative descriptive study	Investigate nurses' knowledge with regard to dressing change and wound pain	94 registered nurses were recruited medical and surgical wards of a large university teaching hospital	A questionnaire
<b>Snow balled from Wound infections and dressings.</b>				
<b>Maida V. et al. (2017) <i>Topical Medical Cannabis: A New Treatment for Wound Pain</i> Three Cases of Pyoderma Gangrenosum</b>	Case study	Case series of three patients with pyoderma gangrenosum that were treated with topical medical cannabis compounded	3 patients with Pyoderma Gangrenosum.	Clinical trial
<b>Renner R., et al (2014) <i>Association of Pain Level, Health and</i></b>	Clinical report	<i>Characterize patients by socio-demographic factors, such as age, gender, co-morbidity,</i>	103 patients from our outpatient wound-care clinic within the Clinic of Dermatology in	EQ-5D is a standardized descriptive self-administered questionnaire

**Wound Status in Patients with Chronic Leg Ulcers**

*pathogenesis of the wound, wound status of new patients, wound pain, and use of analgesics.*

Leipzig, Germany.

measuring health-related quality of life

**McGinnis E et al (2014) Pressure ulcer related pain in community populations: a prevalence survey**

cross-sectional survey

estimate the prevalence of pressure area related pain within a community population

287 patients with pressure ulcers 2 community NHS Sites in the north of England to establish PU pain prevalence

Questionnaire



*Appendix 2 Causes for wound pain*

Theme	Categories	Sub-categories	Authors
Factors contributing to wound pain	Wound itself	Changes in wound status	Cutting (2012) Butcher M & White R (2014) Kevin Y Woo (2015)
		Type of ulceration	Price P. <i>et al</i> (2008), McGinnis <i>et al</i> (2014)
	Local treatment	Wound care procedures	Price P. <i>et al</i> (2008), Bell C, McCarthy G. (2010) Kevin Y Woo (2015)
		Dressings	Price P. <i>et al</i> (2008) White R. (2008) Cutting (2012), Bell C, McCarthy G. (2010)
	Systemic treatment	Insufficient pain management	Price P. <i>et al</i> (2008) Renner R., <i>et al</i> (2014), Butcher M & White R (2014)
	Psychosocial factors	Anxiety	Kevin Y Woo (2015)
	Institutional	Care setting	McGinnis <i>et al</i> (2014), Butcher M & White R (2014)

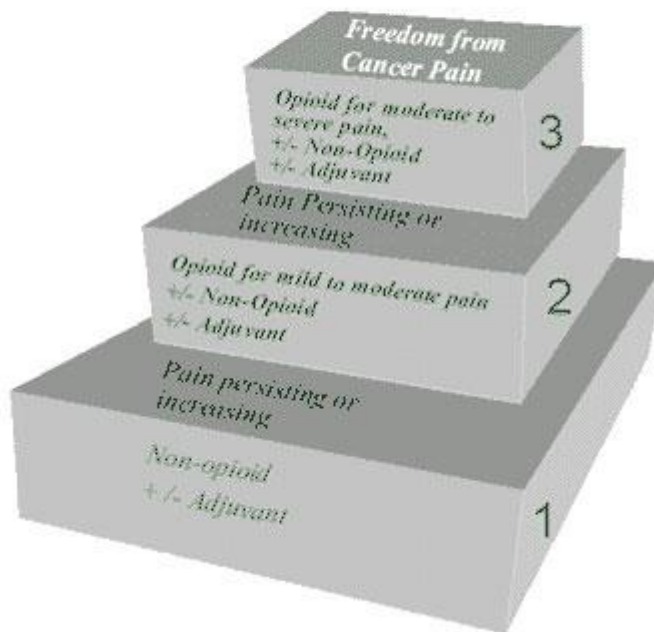
*Appendix 3 Pain management strategies*

Theme	Categories	Sub-categories	Articles
Wound pain management strategies	Institutional	Documentation/assessment	Butcher M, White R (2014), Bell C, McCarthy G. (2010) Cutting KF, White RJ, Mahoney P. (2012), Schaffner N. <i>et al</i> (2012)
		Staff education	Bell C, McCarthy G. (2010)
	Non-pharmacological management strategies	Appropriate dressing selection	Gottrup F. <i>et al</i> (2008) White R. (2008) Price P. <i>et al</i> (2008), Sibbald G. <i>et al</i> (2012), Bell C & McCarthy G. (2010), Cutting KF, White RJ, Mahoney P. (2012)
		Wound handling	Bell C & McCarthy G. (2010), Price P. <i>et al</i> (2008)
		Psychological support	Kevin Y Woo (2015)
	Pharmacological strategies	Systemic	Butcher M, White R (2014); Renner R. <i>et al</i> (2014), Price <i>et al</i> (2008)

		Local	Gottrup F. <i>et al</i> (2008), Sibbald G. <i>et al</i> (2012), Maida V. <i>et al.</i> (2017), Cutting KF, White RJ, Mahoney P. (2012)
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*Appendix 4 WHO's Pain Relief Ladder (WHO int.)*

## WHO's Pain Relief Ladder



*Appendix 5 ‘Painmouse’ device (Sourced from Schaffner N. et al (2012))*

