Infection Control in Aesthetic Medicine

Title	**Infection Control in Aesthetic Medicine**
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Date	December 2020
Version	1.1
Severity	Minor to Major
Frequency	Infrequent

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"If it is a terrifying thought that life is at the mercy of the multiplication of these minute bodies [microbes], it is a consoling hope that science will not always remain powerless before such enemies." Louis Pasteur (1822-1895)

Definition

Infection prevention and control is a scientific approach and practical solution designed to prevent harm caused by infection to patients and healthcare workers[1].

Overview

Microbiology is the study of microbes. Microbes are living organisms so small they can only be seen through a microscope. They are considered the smallest form of life and include bacteria, viruses, fungi, archaea, and protozoa. Microbes that can cause disease are referred to as pathogens. The relationship between the human body and the microbial world is truly dynamic. However, despite this lifelong partnership and the undeniable value these organisms can bring to the human body and the earths ecology, pathogens are capable of destroying human life.

The skin and mucous membranes are the body's protective barrier, if this defence is breached by pathogens, they can reach subcutaneous tissue, muscle, bone, and body cavities. In the field of Aesthetic Medicine, the injection of dermal filler into soft tissue is one of the most sought-after treatments. This procedure can incorporate multiple injection passes from skin to bone. There is a risk of an infectious complication arising from any medical aesthetic procedure that breaches the skin; however, the injection of dermal filler poses a higher risk to patients if strict infection control measures are not adhered to (Table 1).

Table 1: Infection Control Measures

1. Environmental Disinfection
2. Skin Disinfection
3. Hand Hygiene/glove usage
4. Aseptic Technique

This document will offer evidence-based guidance on infection control within Aesthetic Medicine and explore the potential complications that can result as a consequence of inaction. All healthcare professionals (HCPs) have a duty to protect patients from harm. Infection prevention and control is the responsibility of everyone involved in the delivery of Aesthetic Medicine.

1. Environmental Disinfection

As patients and visitors enter the clinic setting, they bring with them their own unique microbiota. As inanimate objects such as door handles, stair rails, surfaces, taps, pens, etc are inevitably touched, contamination and an exchange of microbes is occurring[2].

The practitioner delivering patient care is also harbouring a frenzy of living organisms on their being and must be vigilant with hand washing and asepsis. Microbes on the skin can be killed with the use of antiseptics and surface contamination eradicated with disinfectants. However, over recent years, researchers have noted a steady rise in drug resistant bacteria such as *Enterococcus faecium* and vancomycin resistant *Enterococci spp.* growing a tolerance to alcohol-based disinfectants[2,3,4]. These findings are more relevant to hospital acquired infections, but drug resistant bacteria are now becoming more prevalent in our communities[4]. Anti-microbial resistance is one of the greatest threats to human life. In the clinic environment, if surfaces are not kept

scrupulously clean, there is a risk of contamination and cross infection. In a healthcare facility the source of infection may be the staff, the patient, or the environment. Multiple pathogens can be found on inanimate objects and some have the potential to survive up to four years[2] (Table 2).

Table 2: Some of the most common types of pathogens and how long they can survive on dry surfaces.

Pathogen	Potential survival time
Campylobacter spp.	1 – 4 hours
Candida albicans	1 – 120 days
Cold virus	7+ days
Clostridium difficile (spores)	5 months
E. coli	1.5 hours – 16 months
Flu virus	24 hours
Herpes Virus	Up to 7 days
HIV	1+ week
Listeria spp.	1 day – months
Mycobacterium tuberculosis	1 day – 4 months
Staphylococcus aureus (including MRSA)	7 days – 7 months
Salmonella typhimurium	10 days to 4.2 years

With reference to the current global pandemic, scientists have found that SARS–CoV-2, the virus that causes COVID-19 can be detected on plastic and stainless-steel surfaces for up to three days[54].

Cleaning and disinfecting surfaces in a healthcare setting is fundamental to reduce the risk of infection. As well as scrupulous general cleaning of the clinic environment, disinfection of the treatment chair/couch before and after each patient is essential practice as is disinfecting hard surfaces and other touched surfaces in the treatment area before and after each procedure.

Practitioners can be further guided by the National Infection Prevention and Control Manual (2012)[6] or the Code of practice on the prevention and control of infections and related guidance. (2015)[7].

Alcohol 70%

Most hard surface disinfectants are based on isopropyl or ethanol alcohol 70%, in the form of impregnated wipes or spray. Hard surfaces must be clean and free of contaminants for alcohol to have any microbial effect[8].

The key benefit of alcohol 70% is broad-spectrum activity against a range of pathogenic micro-organisms including *E. coli*, *Pseudomonas aeruginosa*, *Staphylococcus aureus*, *Enterococci spp*., Methicillin-resistant *Staphylococcus aureus*, Hepatitis B and C, HIV and Candida albicans[8]. However, alcohol-based disinfectants are less effective against Norovirus and ineffective against spores[9]. Nonetheless, alcohol-based solutions have been shown to be effective in disinfecting surfaces contaminated with pandemic viruses such as Eboli and SARS coronavirus[8]. Alcohol is highly flammable therefore its use should be limited to small surface areas in well ventilated spaces[10].

Bleach

Active ingredient Sodium Hypochlorite.

Bleach is an alternative chemical to alcohol as a surface disinfectant. It is effective in killing bacteria, fungi and viruses but is easily inactivated by organic material, such as blood. At high concentration, bleach can kill spores (such as *C. Difficile*), however, it irritates mucous membranes, the skin and the airways and can be highly corrosive to surfaces[10].

2. Skin Disinfection

How to interrupt pathogenesis is key to reducing infections associated with injectable treatments in the field of Aesthetic Medicine. Although infections are infrequent, they can have a devastating impact on quality of life[11]. Antiseptic skin disinfection and aseptic technique play a pivotal role in limiting the transfer of pathogens. Skin disinfection is a process that involves the topical application of a disinfectant to the entire area, not just the site of injection, to reduce levels of microorganisms prior to a procedure that breaches the skin. Most surgical site infections are said to originate from the patient's own bacteria entering the wound at the time of the procedure[12]. This supports the need for stringent skin disinfection and the execution of aseptic technique during procedures that breach the skin, the injection of dermal filler is no exception.

Evaluation of frequently used skin disinfectants:

Povidone Iodine (e.g. Betadine® Videne®)
Advantages
Effective against all gram positive and gram-negative bacteria, viruses (including MERS and SARS coronaviruses), fungi and spores[13].
Rapid effect against MRSA[14].
Bacteria do not develop resistance to povidone iodine[15].
Disadvantages
Can cause skin irritation, allergy, and excessive staining of the skin[16].
Inactivated when it comes into contact with blood or serum[16].
No residual effect on the skin, reducing ongoing protection[16].

Chlorhexidine (e.g. Hydrex™ pink, Hydrex™ clear) Chlorhexidine Gluconate 0.5% w/v in 70% Denatured Ethanol B - DEB)
Advantages
Rapid efficacy against a wide range of gram-positive and gram-negative bacteria, yeast, fungi and viruses, including HIV[17].
It provides a persistent and cumulative effective barrier on the skin for at least 6 hours after application (continues to kill bacteria)[18].
Quick-drying and easy to apply, ideal for skin preparation and disinfection prior to invasive procedures[17].
Disadvantages
Ineffective against polioviruses and adenoviruses and is not sporicidal[19].
Chlorhexidine is known to cause dermatitis, irritation to the eyes and to the respiratory tract[20].
Reports of Increasing frequency of life-threatening anaphylaxis[20].
Reports of MRSA and K pneumonia developing resistance to Chlorhexidine[21,55].
Reports of gram-negative bacterial resistance to Chlorhexidine[22].

In 2007 the Food and Drug Administration (FDA) issued a warning to highlight the increase in adverse events seen with chlorhexidine exposure, some resulting in anaphylaxis.

Alcohol 70% w/v (e.g. alcohol impregnated wipes)
Advantages
Ethanol and Isopropyl alcohol are effective anti-microbials[23].
Rapid broad-spectrum activity against bacteria, viruses and fungi[8].
Isopropyl considered superior for skin disinfection (less dehydrating to skin than Ethanol)[23].
Evaporates rapidly leaving no residue on the skin[23].
Disadvantages
Ineffective against spores[9].
Rapid evaporation could result in suboptimal contact time and offers no ongoing protection post procedure[23].

Highly flammable[10].
Although frequently used in hand rubs and pre injection swabs it is more effective as a pre-procedure skin disinfectant when combined with either povidone iodine or chlorhexidine gluconate[23].

Hypochlorous Acid (HCOI) (e.g. Clinisept+®, Natrasan®)
Advantages
Rapidly inactivates bacteria, viruses, fungi, and spores[24].
Non-irritant to skin, eyes, or respiratory tract[24].
Skin neutral pH[25].
The human immune system uses the same hypochlorous chemistry to fight infection, making it extremely biocompatible with human skin[26].
Non-cytotoxic[24,25].
No potential for microbial resistance to develop[24,25].
Extreme disinfectant ability[26].
Disadvantages
Clinical Health Technologies are currently in the process of applying for medical accreditation for Clinisept+®, a product based on the science of hypochlorous acid.
Newly formulated hypochlorous acid based products are in their infancy and lack robust gold standard evidence based research.

Overuse of antibiotics has led to the emergence of superbugs and a whole new world of antibiotic resistant microbes. There is a risk that medicine could return to its pre-antibiotic era if new defences against microbes are not found[24]. The development of hypochlorous acid (HCOI) based products offers a timely response to this need[25]. The introduction of HOCl as a skin disinfectant in the field of aesthetic medicine is a major advance of the 21st century[27]. It has been reported that the need for skin disinfection is as necessary as ever given the now universal understanding that even a needle stick injury can allow the ingress of biofilm and lead to infection[21].

Anti-Microbial Mouthwash (Hypochlorous acid or Chlorhexidine based Mouthwash)

It has been estimated that there are between 500 and 650 different species of micro-organisms in and around the mouth[28]. An antiseptic mouth wash used prior to dermal filler injections to the lip area will reduce bacterial flora for approximately 8 hours and will also minimise the risk of contamination when lip licking[29].

Dental treatments should be carried out either 2 weeks before the injection of dermal filler or 2 weeks after to reduce the risk of haematological bacterial spread[30].

Makeup Removal Prior to Skin Disinfection

There is a substantial volume of reports in the literature about the absolute necessity to remove make up from the skin before the injection of dermal filler, however, the evidence is predominantly consensus of expert opinion[30,31,32,33]. A study commissioned by Rakish Aggrawal, the CEO of the online cosmetic company escentual.com, reports findings of concern[34]. Dr Paul Matewele, senior lecturer in Biomedical Science at the London Metropolitan University conducted the study, he tested 5 items of makeup that were close to the use by date or just over and reported that under strict laboratory conditions, all items tested positive for the bacteria *Enterococcus faecalis*. This is a deadly strain of bacteria that can cause meningitis and septicaemia and is one of the biggest killers of new-born babies[34]. Other bacteria found growing in the make-up and the potential health risks are listed in Table 3.

This is evidence enough to support why the skin must be completely free of makeup, cleansed and then disinfected before the

injection of dermal filler. The skin must remain free from make up for 12 hours post injection. There are no universal guidelines for skin disinfection prior to the injection of dermal filler, this is a major gap in global patient health and safety[27].

Table 3: Contaminated Makeup Study[34]

Pathogen	Effects
Ubacterium spp.	A cause of bacterial vaginosis.
Aeromonas spp.	Gastroenteritis and wound infections.
Staphylococcus epidermidis	A bacterium which is resistant to antibiotics and can be deadly to people in hospital or to those who have catheters or surgical implants.
Propionibacterium spp.	One of the main causes of acne and other skin conditions.
Enterobacter spp.	A cause of urinary and respiratory tract infections.

3. Hand Hygiene and Glove Usage

Hand Hygiene

Handwashing is considered the most important barrier to cross-infection. There is now undisputed evidence that strict adherence to hand hygiene reduces the risk of infections[35]. The hands are colonised by two types of microbes, the permanent resident flora that consists of micro-organisms living under the cells of the stratum corneum and the transient flora which colonise the superficial layers of the skin[35]. Transient flora are not present on the skin at all times, they may transfer during patient contact and by the touching of inanimate surfaces and are more susceptible to removal from the skin with handwashing. Although handwashing in healthcare has improved in recent years, good practice is not universal. Research continues to show low compliance rates among healthcare workers[35]. Increasing healthcare workers compliance with hand hygiene remains a global challenge[27]. Hibiscrub® is an antimicrobial skin cleanser containing 4% chlorhexidine gluconate and is widely used in both primary and secondary care. Hibiscrub® will inactivate micro-organisms present on the hands to prevent transmission of microbes. This is achieved by the active ingredient, chlorhexidine gluconate, binding to the skin to form an effective barrier that will not only kill bacteria but continue to give residual protection for several hours.

NICE guidelines advise that when delivering direct patient care, wrist and hand jewellery are removed, fingernails are short, clean and free of nail polish and any cuts or abrasions covered[36]. Moreover, the bare below the elbow rule must be adhered to, appropriate glove usage implemented, and a single use disposable apron adorned as part of personal protection equipment when delivering direct medical aesthetic care[36].

Glove Usage

The decision to wear gloves is based around an assessment of the risk of contact with blood, body fluids, secretions and/or excretions, non-intact skin, mucous membranes, chemicals, or hazardous drugs[37]. Gloves are worn to protect both the HCP and the patient. Table 4 provides a summary of glove usage/removal[38].

Table 4: Summary of the indications for glove usage and for glove removal[38].

Gloves On
1. Before a sterile procedure.
2. When anticipating contact with blood or another body fluid regardless of the existence of sterile conditions and including contact with non-intact skin and mucous membranes.
3. Contact with a patient (and his/her immediate surroundings) during contact precautions.
Gloves Off
1. As soon as gloves are damaged or non-integrity suspected.
2. When contact with blood, another body fluid, non-intact skin and mucous membrane has occurred and has ended.
3. When contact with some single patient and his/her surroundings, or a contaminated body site on a patient has ended.
4. When there is an indication for hand hygiene.

It has long been recognised that the wearing of gloves reduces the transmission of micro-organisms and contaminated matter via the healthcare workers hands, however, there are growing concerns that the wearing of gloves is becoming a substitute for effective hand hygiene[39]. Gloves do not eliminate contamination of hands and become a source of infection risk to patients if not changed appropriately between each procedure and patient contact. Several studies have identified that the compliance level of hand washing significantly reduces when gloves are worn[39,40]. The prolonged use of gloves in the absence of considering the need to perform hand washing can result in the transmission of microbes. Moreover, there are reports of healthcare professionals decontaminating gloves with soap and water or an alcohol-based hand rub as a means of infection control between patients or procedures[39]. Disposable gloves are single use medical devices and in accordance with Health and Safety requirements are considered personal protective equipment[37]. Pathogens can contaminate gloved hands by means of defects in the glove material or during removal of the gloves[37]. Hand washing with an appropriate anti-microbial solution such as Hibiscrub® is essential practice before the application and the removal of gloves. No glove material provides absolute protection against all potential risks in the clinical setting.

Evaluation of Glove types

Disposable Vinyl Gloves
Low tensile strength, rigid and inflexible and are prone to splitting[37].
Increased permeability to blood borne viruses – unsuitable for any procedure where there is a risk of contact with blood or other body fluids[37].
Leakage rates of up to 63% reported[37].
Vinyl gloves, polythene gloves or gloves made from copolymer material should not be used for clinical purposes[56].

Disposable Nitrile Gloves (sterile and non-sterile)
Reliable barrier against viral and blood borne pathogens[37].
Good protection against microbial contamination[37].
Highly resistant to tears or punctures[37].
Brightly coloured making gloves easy to identify.
Suitable alternative to latex gloves when sensitisation/allergy has been identified[37].
Non--sterile disposable nitrile gloves are suitable for examination purposes and procedures that do not breach the skin barrier[27].
Sterile nitrile gloves, refer to heading: Sterile surgical gloves.

Disposable Latex Gloves (sterile and non-sterile)
Give the best fit, best dexterity, and most comfort due to high elasticity and strength[37].
High degree of tactile sensitivity[37].
Excellent microbial barrier protection[37].
Found superior to nitrile in simulated needle stick injury study[41].
Increasing prevalence of latex allergy has led to reduction in use[37].
Nitrile gloves are a safer alternative.
Sterile latex gloves, refer to heading: Sterile surgical gloves.

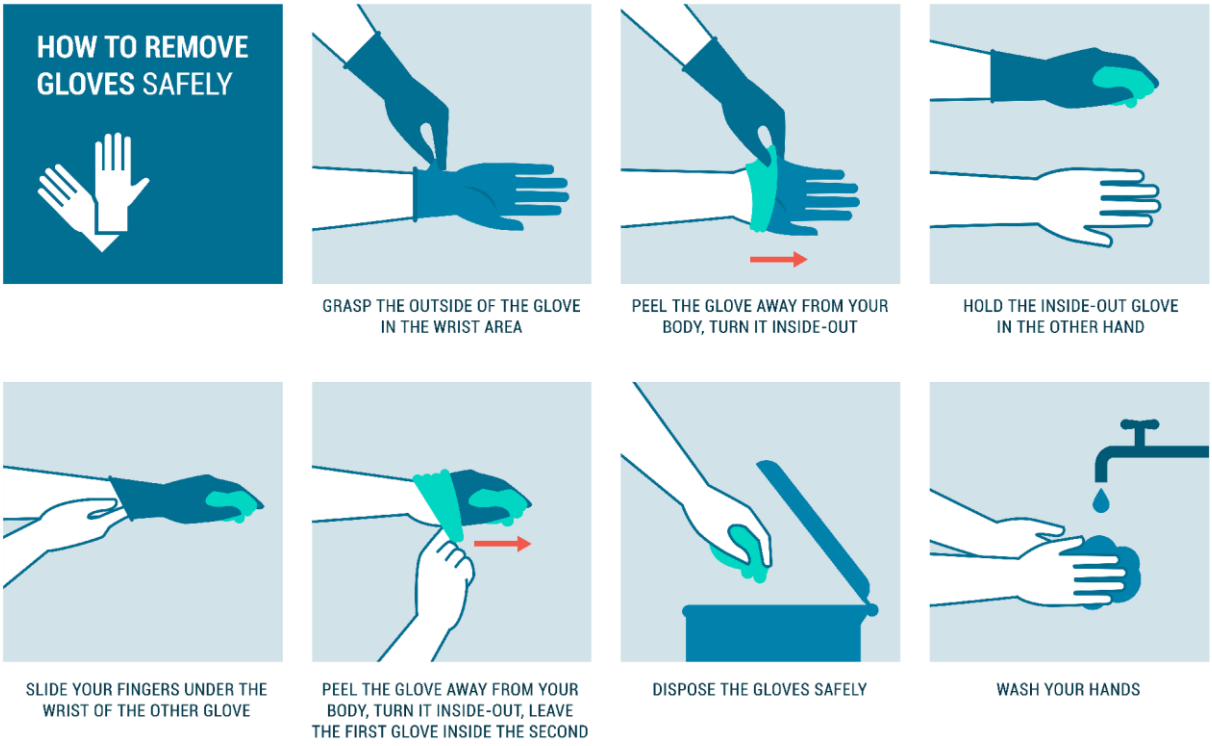
Sterile Surgical Gloves

Sterile gloves should be worn for surgical procedures, for invasive procedures and for the insertion of an invasive device[37]. The injection of dermal filler should be considered an invasive procedure and the insertion of a device, both requiring the execution of an aseptic technique. All medical aesthetic procedures that breach the skins integrity should merit the application of sterile gloves. It is important to carefully don sterile gloves to protect the patient, but it is as equally important to remove gloves correctly to reduce the risk of contamination to the practitioner. **Figure 1** demonstrates the correct removal of contaminated gloves.

4. Aseptic Technique

Aseptic technique can be defined as a healthcare procedure designed to minimise the risks of exposing a patient to pathogenic micro-organisms during simple and complex procedures[36]. The application of aseptic technique is central to reducing healthcare associated infections. It is presumed that healthcare professionals reading this guidance are experienced in the execution of aseptic technique thus precluding the need to give a step-by-step account within this guidance. Aseptic technique must be applied when administering dermal filler.

Figure 1: Correct removal of contaminated gloves.

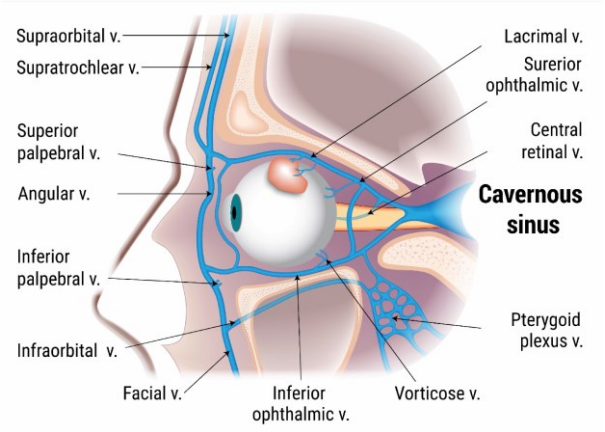


Dermal Filler Associated Infections

Infection rates after the injection of dermal filler are reported in the literature as low[32]. However, the author postulates that there is a growing body of evidence to support that complications once thought to be of an immunogenic nature are in fact of an infectious nature, this compounded by the reluctance of practitioners to report complications gives rise to the likelihood of inaccurate data on infection rates associated with dermal fillers[27]. There is no universal reporting system in place to collate accurate data regarding infection rates. The literature supports that the most common infections arise when skin contaminants infiltrate the site of injection at the time of injection[32] (Refer to the Aesthetic Complications Guidelines on Acute Infection). This would suggest that inadequate skin disinfection prior to injecting plays a significant role in this process. This is further supported in the work of Wagner who also reports microbes being introduced through direct inoculation during injection or by the haematologic spread of a systemic infection[31]. Clinical evidence supports that if active infections such as sinusitis, periodontal disease, ear, nose, or throat infections are present at the time of injecting dermal filler, there is a risk the infection could subsequently invade the implanted filler material inducing a biofilm[43]. It is therefore imperative that patients are well and infection free at the time of injecting.

Furthermore, there is a substantial volume of evidence in the literature to support that infections that originate in the sinuses, face, ears or oral cavity have the potential to drain into the cavernous sinus with grave life-threatening consequences, dermal filler associated infection in these areas are no exception[44,45]. Cavernous sinus Infection can lead to the formation of multiple abscesses and result in neurological and/or ophthalmological damage[44]. A septic cavernous sinus thrombosis has the potential to occlude the retinal artery leading to permanent iatrogenic blindness[44]. This strongly supports why infection control within Aesthetic Medicine must be taken very seriously because the consequences of inaction could prove to be catastrophic or indeed fatal.

Figure 2: Location of the cavernous sinus.



Acute Skin Infection

Acute skin infections can present as a localised skin infection, deeper cellulitis, or abscess formation[31]. Symptoms typically develop over 3-7 days and include redness, heat, pain, inflammation and swelling[32]. A nodule or pustule may form[32] and systemic symptoms of infection may also be present[31].

Early infection post dermal filler is typically due to a low-grade bacterial infection from skin micro-organisms such as *Staphylococcus aureus*, *Staphylococcus epidermidis* and *Propionibacterium spp.* that invade the injection site[32]. Sebaceous glands are known to have a significant biofilm burden; this is another potential source of contamination for filler material[46]. An early onset inflammatory nodule that is red and painful should be treated as infection, if left untreated an acute skin infection can lead to sepsis[47].

There is a substantial body of evidence to support that most complications of an infectious nature begin at the time of injecting due to inadequate infection control[30,31,32]. There is no doubt that improved infection control strategies are required to reduce the microbial burden at the time of injecting.

Delayed Onset Nodules

A delayed onset nodule may be a visible or palpable mass at or close to the injection site of dermal filler[48]. They may present as nodules, indurations, type 4 delayed hypersensitivity reactions, biofilms, abscesses, or granulomas[48,49]. Symptoms can present weeks or months post injection[48].

Most late and delayed onset inflammatory and nodular complications post dermal filler have an infectious origin[50]. It is widely accepted that biofilm infection is responsible for most delayed complications post dermal filler and the leading cause of device associated infections[49]. Biofilms can exist for a long period of time in a dormant state, but reactivation of infection can be triggered by trauma such as more dermal filler being injected close to the biofilm, dental treatments, haematogenic infection or iatrogenic manipulation[50,51].

Minimising Patient Risk of Infection

Infection control is key to minimising the risk of infection to the patient, however, there are other factors to consider prior to injecting. The practitioner must elicit a full medical, cosmetic, drug and allergy history, incorporating information about any previous dermal filler treatments or complications and where possible establishing the type or brand of product/s injected[27]. Periodontal health should be part of the medical history.

The injection of dermal filler over a permanent implant poses the risk of contamination to the existing implant with the potential to cause an infection such as abscess formation[52]. It is pertinent to note that the number of microbes required to cause a clinical infection is dramatically reduced from 1,000,000 to 100 per gram of tissue in the presence of a foreign body, such as dermal filler[50]. A patient with an active skin infection is not a suitable candidate for dermal filler treatment. Similarly, inflammatory skin conditions require careful consideration and caution[30].

The literature supports that inadequate infection control within the clinic setting is contributing to the development of dermal filler associated infections[27]. However, the recommended guidance below is relevant to all medical aesthetic procedures that breach the skin. It is hoped that in the future as regulation within our sector improves, a formalised infection control programme specific to Aesthetic Medicine is developed and a standardised method of reporting infection is created.

Evidence Based Guidance

- Environmental disinfection with a 70% alcohol based hard surface disinfectant.
- Patients skin cleansed and all traces of makeup removed prior to any procedure that breaches the skin.
- Patients hair covered (if appropriate to procedure).
- Skin disinfected with a hypochlorous acid-based product (before, during and after procedure).
- Practitioners hands washed with Hibiscrub® before and after every patient contact and before the application of gloves and on removal of gloves.
- Sterile Nitrile Gloves donned for all procedures that breach the skin.
- Aseptic technique executed for all procedures that breach the skin.
- Wrist and hand jewellery removed, fingernails clean short and free from nail

polish, hair tied back (if appropriate) and disposable single use apron adorned during aseptic technique.

- Bare below the elbow rule must be adhered to when executing an aseptic technique.

COVID-19: Additional infection control measures

In addition to the above, practitioners must also don a 3-ply surgical mask for low-risk procedures and an N95/FFP2 respirator mask for medium and high-risk procedures as per consensus guidance[5]. Eye protection (face shield/goggles) must also be worn for all categories of procedures as per consensus guidance[5].

Enhanced Infection Control Measures

In response to the current global pandemic of the SARS-CoV-2 virus that causes COVID-19 infection, additional infection control measures must be implemented within the medical aesthetic clinic the entire duration of the pandemic.

COVID-19 Pandemic: Consensus Guidelines for Preferred Practices in an Aesthetic Clinic (Kapoor et al 2020)[5] have been produced by ten global experts to provide practitioner guidance on enhanced infection control measures during the pandemic. There is compelling evidence to support the use of face masks and eye protection in the healthcare setting[53]. The expert consensus group have categorised medical aesthetic procedures into low risk, moderate risk and high risk based on the likelihood of transmission of SARS-CoV-2 virus from the patient to the practitioner. Other factors taken in account by the consensus group were aerosol generating procedures (high risk) versus non aerosol generating (lower risk), which part of the body is being treated and duration of treatment, with appropriate evidence-based guidance given. Furthermore, air purifiers with a HEPA filter are discussed and recommended as an important enhanced infection control measure. The author advises that practitioners access these guidelines to further enhance infection control measures in the clinic environment.

References 32&42 duplicated

1. World Health Organisation: Infection prevention and control (online) https://www.who.int/infection-prevention/en/
2. Rutterford L. Infection Control. *Aesthetics Journal* 2017; *5th May*
3. Newman T. Bacteria are becoming resistant to alcohol-based disinfectants (2017) (online) www.medicalnewstoday.com
4. Nield D. Superbugs are growing more resistant to alcohol (2018) (online) www.sciencealert.com
5. Kapoor et al. COVID-19 Pandemic: Consensus Guidelines for Preferred Practices in an Aesthetic Clinic. *Dermatologic Therapy* 2020; 33(4): 4 July/August 2020
6. NIPCM 2012 National Infection Prevention and Control Manual (2012) (online) www.nipcm.hps.scot.nhs.uk
7. The code of practice in the prevention and control of infection and related guidance (2015) https://www.gov.uk/government/consultations/prevention-and-control-of-infections-code-of-practice
8. Rutala WA, Weber DJ. Disinfection, sterilisation and anti-sepsis: an overview *Am J infect Control* 2016;44: e1 – e6
9. Edmonds SL, Zapka C, Kasper D, Gerber R, McCormack R, Macing D, et al. Effectiveness of hand hygiene for removal of *Clostridium difficile* spores from hands. *Infect Control Hosp Epidemiol.* 2013;34: 302–305
10. World Health Organisation: Infection Prevention and Control of Epidemic-and Pandemic Prone Acute Respiratory Infections in Health Care. (online) http://158.232.12.119/csr/bioriskreduction/infection_control/publication/en/
11. Phillips K, Scott D, Wang YI. US Food and Drug Administration: Dermal Filler Materials, Injections, Methods and Skin Preparation. *Plastic and Reconstructive Surgery:* 2017; 140(4): 632 -633
12. Ayliffe GA. Role of the environment of the operating suite in surgical wound infections. *Clinical Infectious Diseases 1991;13(10): 800 – 804*
13. Eggers M. Infectious Disease Management and Control with Povidone Iodine. *Infect Dis Ther* 2019;8(4): 595
14. Haley CE, Marling-Carson M, Smith JW, Luby JP, Mackwiak PA. Bactericidal Activity of Antiseptics Against Methicillin-Resistant Staphylococcus Aureus. *Journal of Clinical Microbiology* 1985: 991 – 992
15. Fleischer W, Reimer K. Povidone Iodine in antisepsis – state of the art. *Dermatology 1997;195 (suppl 2): 3 – 9*
16. Harke P. Disinfectant: Ullmann's Encyclopaedia of industrial chemistry Wiley VCH, 2000
17. Horner et al. Reduced susceptibility to chlorhexidine in staphylococci: is it increasing and does it matter? *Journal of Antimicrobial Chemotherapy* 2012;67(11): 2547 – 2559
18. Milstone AM, Pasinetti CL, Perl TM. Chlorhexidine: expanding the armamentarium for infection control and prevention. *Clin Infect Dis* 2008;46(2): 274- 281
19. McDonnel G, Russell D. Antiseptics and disinfectants: activity, action and resistance. *Clin Microbiol Rev* 1999;12(1): 147 – 79
20. ASCIA (Australian society of clinical immunology and allergy) (2017) Chlorhexidine Allergy (online) www.allergy.org.au
21. Wand ME, Bock LJ, Bonney LC, Sutton JM. Mechanisms of increased resistance to chlorhexidine and cross resistance to colistin following exposure of Klebsiella pneumoniae clinical isolates to chlorhexidine. *Antimicrob Agents Chemother* 2016 Dec 27;61(1): e01162 – 16

22. Hashemi MM, Holden BS, Coburn J, Taylor MF, Weber S, Hilton B, Zaugg AL, McEwan C, Carson R, Andersen JL, Price JC, Deng S,Savage PB. Proteomic Analysis of Resistance of Gram-Negative Bacteria to Chlorhexidine and Impacts on Susceptibility to Colistin, Antimicrobial Peptides Savage *Front Microbiol* 2019;10: 210. Published online 2019 Feb 18. doi: 10.3389/fmicb.2019.00210
23. Kampf G, Kramer A. Epidemiogic Background of Hand Hygiene and Evaluation of the Most Important Agents for Scrubs and Rubs. *Clin Microbiol Reviews* October 2004: 863 – 893
24. Walker R (2018) CEO Clinical health technologies
25. Bowes L (2016) Could a technology from the past change skin disinfection for the future? PMFA news;4(6) (online) www.pmfanews.com
26. Wang L, Bassiri M, Najafi R et al. Hypochlorous acid as a potential wound care agent: part 1 stabilised hypochlorous acid: a component of the inorganic armamentarium of innate immunity. *J of Burns Wounds* 2007 April 11;6: e5
27. Collier H. Infection Control in Aesthetic Medicine and the consequences of inaction. *J of Aesthetic Nursing* 2018;Vol 7(7): 352
28. Bik EM et al. Bacterial diversity in the oral cavity of ten healthy individuals. *ISME J* 2010 Aug;4(8): 962-74
29. Hermesch CB, Hilton TJ, Biesbrock AR et al. Perioperative use of chlorhexidine gluconate for the prevention of alveolar osteitis: efficacy and risk factor analysis. *Oral Surg Oral Med Oral pathol Oral Radiol Endod* 1998;85: 381-387
30. De Boulle K. Patient factors influencing dermal filler complications: prevention, assessment and treatment. *Clin Cosmet Investig Dermatol* 2015;(8): 205 – 214
31. Wagner et al. Aetiology, Prevention, and Management of Infectious Complications of Dermal Fillers. *Semin Plast Surg* 2016;30: 83 – 86
32. Ferneini et al. An Overview of Infections Associated with Soft Tissue Facial Fillers: Identification, Prevention and treatment. *J Oral Maxillofacial Surg* 2017;75: 160 – 166
33. Signorini et al. Global Aesthetics Consensus: Avoidance and Management of Complications from Hyaluronic Acid Fillers – Evidence and Opinion Based Review and Consensus Recommendations. *Plastic and Reconstructive Surgery* June 2016;6: 961e – 965e
34. Matewele P. Out of date make up can contain lethal bacteria. London Metropolitan University (2015) (online) www.londonmet.ac.uk/news/articles/mke-up
35. Mathur P. Hand Hygiene: Back to the basics of infection control. *The Indian Journal of Medical Research* 2011;134(5): 611 – 620
36. Nice Guideline (2012) Healthcare associated infection: prevention and control in primary and community care. (online) www.nice.org.uk
37. NHS, National Services Scotland, Infection Control Team (2016) Standard Infection Control Precautions (SICPs) Literature Review: Personal Protective Equipment – Gloves *Health Protection Scotland Version 3.0 July 2016*
38. Pittet D. Improving adherence to hand hygiene practices: a multi-disciplinary approach. *Emerging Infectious Diseases* 2001;7(2): 234 – 24
39. Fuller C, Savage J, Besser S, Hayward A, Cookson B, Cooper B, Stone S. "The Dirty Hand in the Latex Glove": A Study of Hand Hygiene Compliance When Gloves are Worn. *Infection Control and Hospital Epidemiology* 2011 Dec;32(12): 1194 – 9
40. Flores A, Pevalin D. Glove use and compliance with hand hygiene. *Nursing Times* 2007; 103(38): 46 – 48
41. Mansouri M, Tidley M, Sanati KA, Roberts CA. Comparison of blood transmission through latex and nitrile glove materials. *Occup Med (Lond)* 2010 May;60(3): 205 – 2010

42. Ferneini et al. An Overview of Infections Associated with Soft Tissue Facial Fillers: Identification, Prevention and treatment. *J Oral Maxillofacial Surg* 2017;75: 160 – 166
43. Narins S. Biofilms from dermal fillers management with proper course of action. (2011) http://tinyurl.com [Accessed May 2018]
44. Chen et al. Septic Cavernous Sinus Thrombosis: An unusual and fatal disease. *J Formos Med Assoc* Mar 2006:105(3); 203 – 209
45. Chick et al. Bilateral cavernous sinus thrombosis following community acquired methicillin resistant staphylococcus aureus infection: A case report and review of the literature. *J Miss State Med Assoc* 2010 Nov;51(11): 317-20
46. Ashkenazi et al. Eradication of Propionibacterium acnes by its endogenic porphyrins after illumination with high intensity blue light. *FEMS Immunol. Med Microbiol* 2003;35: 17 – 24
47. Sclafani AP, Fagan S. Treatment of injectable soft tissue filler complications. *Dermatol Surg* 2009;35(suppl 2): 1672 – 80
48. Signorini et al. Global Aesthetics Consensus: Avoidance and Management of Complications from Hyaluronic Acid Fillers – Evidence and Opinion Based Review and Consensus Recommendations. *Plastic and Reconstructive Surgery* June 2016;6: 961e – 965e
49. Saththianathan et al. The Role of Bacterial Biofilm in Adverse Soft Tissue Filler Reactions: A combined Laboratory and Clinical Study. *Plast and Reconstr Surg* 2017;139(3): 613 – 621
50. Dumitrascu D, Georgescu A. The management of biofilm formation after hyaluronic acid gel filler injections: *A review Clujul Medical* 2013;86(3): 192 – 195
51. Narins S (2011) Biofilms from dermal fillers management with proper course of action. (2011) http://tinyurl.com [Accessed May 2018]
52. Rzany B, De Lorenzie C. Understanding, Avoiding, and Managing Severe Filler Complications. *Plast Reconstr Surg* 2015;136(5s): 196s – 203s
53. Chue et al. Physical distancing, face masks and eye protection to prevent person to person transmission of SARS-CoV-2 and COVID 19: a Systematic review and meta-analysis. *The Lancet* June 1st, 2020
54. Van Doremalen N et al. Aerosol and Surface Stability of HCoV-19 (sars-CoV2) compared to SARS CoV-1. *N Engl J Med* 2020;382: 1564-7
55. Homer C, Mawer D, Wilcox M. Reduced Susceptibility to chlorhexidine in staphylococcus: is it increasing and does it matter*? J Antimicrob Chemother* 2012;67(11): 2547 – 59
56. NHS Salisbury Foundation Trust (2015) Glove Usage Policy www.icid.salisbury.nhs.uk
57. NES (2014) Healthcare associated Infections – ASEPTIC Technique www.nes.scot.nhs.uk

Infection Control in Aesthetic Medicine

ACE Group World have produced a series of evidence based and peer reviewed guidelines to help practitioners prevent and manage complications that can occur in aesthetic practice. These guidelines are not intended to replace clinical judgement and it is important the practitioner makes the correct diagnosis and works within their scope of competency. Some complications may require prescription medicines to help in their management and if the practitioner is not familiar with the medication, the patient should be appropriately referred. Informing the patient's General Practitioner is considered good medical practice and patient consent should be sought. It may be appropriate to involve the General Practitioner or other Specialist for shared care management when the treating practitioner is not able or lacks experience to manage the complication themselves. Practitioners have a duty of care and are accountable to their professional bodies and must act honestly, ethically, and professionally.

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