**Ultrasonic cleaning – An effective physical force**
In ultrasonic cleaning, the physical effects on the biofilm are caused by a phenomenon called cavitation. If generated in fluids, high-frequency sound waves (ultrasound) create shock waves that tear away both biological material as well as inorganic soil from the articles being processed, so that cleaning agents can reach the surfaces of the items.
The forces in the shock waves in the ultrasonic cleaner (the cavitation effect) will be so strong that they not only tear away the soil on processed articles, they also affect the surfaces of these articles, causing smooth instrument surfaces to become uneven. This in turn makes the instrument surface rough and pitted, which increases the possibilities of microorganisms and soil to attach to the instruments, also making them more difficult to clean by increased number of ultrasonic cleaning processes.

Some types of instruments should never be processed in ultrasonic cleaners due to the risk of causing rough surfaces. Drills for bone implants are one example: a rough surface will cause increased friction between the drill and the bone structure during use. Bone is extremely sensitive to increase in temperature. An increase in temperature of 5°C can cause local bone necrosis and thereby the loss of the implant.

Presoaking of instruments before the ultrasonic cleaning is essential. Materials that will harden and stick to the instruments (bone cement etc) must be removed directly at the point of use. If allowed to harden on the instruments, such materials will be impossible to remove without destroying the instrument.

When using ultrasonic cleaners, detergents specifically designed for this purpose should be used. The strong shock waves created by the ultrasound also affect the chemicals in the detergents.
The strong shock waves also cause an increase in temperature. This is why certain types of disinfectants must never be used in ultrasonic cleaners. Disinfectants containing alcohol entail a risk of explosions at elevated temperatures.

Because of the increase in temperature, there is a risk of coagulation of protein that can occlude microorganisms if the instruments are not pre-soaked and carefully rinsed before the ultrasonic cleaning.

After ultrasonic cleaning, instruments should be thoroughly cleaned and rinsed again in order to make sure that all possible contamination from water in the ultrasonic bath is removed. This cleaning should then be followed by disinfection and sterilization of the instruments.

Ultrasonic cleaners have a limited lifetime. To be effective they must generate high-frequency sound waves within a certain range. If the frequency of the sound waves is too low, the cleaning process will not be effective. The cleaning device should therefore be checked at regular intervals with specific process challenge devices.

**Cleaning: the prerequisite for sterilization**
The most effective stage of any decontamination procedure is thorough physical cleaning, which should accompany or precede all disinfection procedures. Most equipment-associated infection is due to inadequate cleaning and disinfection.

**Limited anti-microbial effect**
Cleaning involves the removal of organic substances and other residues from a surface or item, but cleaning in itself has no microbial killing action and should therefore not be confused with decontamination and disinfection.

**“Bioburden”**
The term “bioburden” is most often defined as the microbiological load, e.g. the number of contaminating organisms in the product/item prior to cleaning, disinfection and sterilization. An item heavily loaded with biological material will be more difficult to sterilize than one that is only lightly contaminated. Medical devices requiring sterilization or disinfection must therefore be thoroughly cleaned to reduce organic material or bioburden.

Bioburden can also be biological materials such as blood, mucous, fluids, feces, etc, and when present on items to be processed for reuse, will contribute to failure of the disinfection or sterilization procedure.

**Physical cleaning is the key**
Physical cleaning is the most important step in a disinfection and sterilization process. Physical cleaning means the use of mechanical (kinetic) energy. The aim is to remove residual bioburden and biofilm from all surfaces of the instruments/articles. This must be done without harming and destroying the surface of the items.

**Don't use hands**
The process of manual cleaning must involve thorough scrubbing of all the surfaces of the item and rinsing of the item in clean water. It is important to stress that manual cleaning requires a high level of training and is time-consuming.
Automated processors offer the safest, most reliable option, provided they are suitably monitored and maintained.
***Manual cleaning should be restricted to situations when automated methods are inappropriate or unavailable.***

**Why not manual cleaning ?**
There are several reasons for preferring automated processes if possible. Manual cleaning in healthcare settings requires adequate training and skills.
It has been shown that hand-washing of items in still water reduces the microbial bioburden. However, although the hand-washing procedure is effective in reducing the microbial levels deposited on the surgical instruments, the risk of recontamination from microorganisms in the water increases rapidly unless the water is changed frequently.

In manual washing of instruments and other medical devices, great accuracy most be attended to follow precise guidelines about regular changes of water, water temperature, concentration of detergents, rinsing procedures etc. Also the personnel must be well protected against splashing, puncture wounds etc.