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Application Support Information

7 steps to ensure safe water in hydrotherapy

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Water used in hydrotherapy must be safe and clean to protect patients who have compromised immune systems. The 7 key recommendations will ensure to reduce risks of new infections from inadvertent exposures to environmental pathogens for patients recovering from many conditions.

Introduction

Nowadays hydrotherapy is common practice both as alternative medicine and as part of mainstream hospital's physiotherapy treatments. Techniques are continually improved through worldwide research investigating new ways to use the benefits of water to improve health; their outcome can be

found in peer-reviewed journals such as the Archives of Physical Medicine and Rehabilitation and the International Journal of Aquatic Research and Education. Hydrotherapy refers to the therapeutic use of water due to body's physiological responses submitted at various temperature and specific equipment (pools, whirlpools, whirlpool spas, hot tubs, and physiotherapy tanks), while aquatic therapy uses the resistance of water in rehabilitating patients after injury or with chronic illness, and in improving athletic performance. For both types of therapy, it is essential to ensure safety and quality of the water before any patient enters the pool.

Hydrotherapy facilities are accessible within senior living centres or physical therapy facilities from hospitals or charities. Physiotherapists also recommend hydrotherapy and aquatic therapy for improving recovery times following surgery and injury and for giving athletes a strenuous workout with reduced risk of injury. Facilities have been designed and dedicated to athletes from the world's foremost athletic organizations. All types of hydrotherapy facilities will require monitoring relevant environmental infection-control strategies and engineering controls.

The 7 following steps will reduce health risks to users including spread of infection and minimize discomfort, while maximizing the longevity of the facility structure and minimizing operation costs.

1. Monitor temperature

- The temperature in the hydrotherapy suite should be recorded twice daily and should remain at 35.5 to 36°C, and never go above 38°C.
- Patients with certain medical conditions such as [neuropathy](#) have lost the ability to detect changes in temperature and therefore temperature measurement is vital.
- Precautions must be taken for patients with a condition that could be worsened by exposure to extremes of heat for extended periods. As an example, higher temperatures can affect patients with heart disease, lung disease or circulation disorders.
- Recent studies also show that colder temperatures may worsen symptoms in patients with Raynaud's disease, chilblains, acrocyanosis, or erythrocyanosis.

How to monitor temperature?

2. Monitor pH

- pH is a measure of the relative balance of acids and alkalis in water. If the pH is too low, eye sting and skin irritation can occur while the pool and its fittings can be damaged by corrosion. If the pH is too high, the disinfection process is less effective, scale formation can be promoted and the water can become cloudy.
- The effectiveness of chlorine and other disinfectants is largely influenced by the pH of the water. Chlorine loses its disinfection capacity at higher pH levels. To ensure disinfectants achieve maximum effectiveness, it is critical that the pH of the water is maintained within a defined range.
- pH should be measured at the beginning of the day, then every 2 hours and finally at the end of each day. It should fall within the range 7.2 - 7.8.

How to monitor pH?

3. Ensure disinfection control and check Water Balance

- The most common chemical used for disinfection is chlorine.
[How to measure chlorine?](#)
- Optimize the disinfection treatment to avoid skin irritation (dermatitis) or bacterial skin infections, particularly when patients have open wounds. Dermatitis may be caused by contact with contaminants or additives in water such as dichloramines and trichloramines formed by reaction with organic compounds (skin, sweat, urea...) when using chlorine.
- Free Chlorine should be measured at least three times a day and should be between 1.5 and 5.0 mg/l. Total Chlorine should be measured at the same time as Free Chlorine and Total Chlorine levels must be no greater than 10 mg/l whilst a facility is in use. It is recommended that facilities be operated with combined chlorine (Total Chlorine minus Free Chlorine) levels no greater than 30% of the Free Chlorine.
Learn more [here](#).
- Cyanuric acid and Total Dissolved Solids (TDS) should be measured daily. Where cyanuric acid is used, it should be maintained at a level of 30 – 50 mg/l and never exceed 200mg/l. It is recommended that the TDS level in the pool be maintained at no more than 1000mg/l above the TDS level of the supply water and not exceeding 1500mg/l. It is advisable to prevent excessively high TDS levels from accumulating, as they may result in accelerated corrosion of metal components.
- The alkalinity is a measure of the ability of the water to resist changes in pH. The alkalinity should be maintained within the range 60 – 200mg/l.
- The calcium hardness should be maintained within the range 50-400mg/l. If the calcium hardness is too low, the water becomes corrosive. If the calcium hardness is too high, the result will be scale formation causing reduction of filtration efficiency and increase energy costs.
- [Water Balance](#) is derived from the measurements of pH, alkalinity, calcium hardness, temperature and TDS and is a useful tool for hydrotherapy water management by informing about risks of corrosion or scaling.
Learn more about [Palintest Water Balance Index](#), and about [Langelier Water Balance Index](#).

4. Monitor the microbiological contamination

- Microbiological contamination of the pool can result in pathogenic microorganisms causing infections to bathers. These contaminants can be introduced into the pool by bathers, from the pool filters and occasionally from defects in the pool engineering.
- In the UK, there are a number of documents that provide guidance about the microbial quality of water to be used for hydrotherapy pools, as well as general guidelines relating to Legionella and *P. aeruginosa* in hospital water. These documents also indicate the microbiological tests necessary to ensure that the quality of hydrotherapy water falls within safe levels.
- To maintain water quality, The Pool Water Treatment Advisory Group (PWTAG) recommends regular microbiological testing of hydrotherapy pool water according to guidelines laid down in a BSI Code of Practice: PA39:2003 'Management of Public Swimming Pools. Water Treatment Systems, Water Treatment Plant and Heating and Ventilation Systems'.
- Hydrotherapy pools should be tested twice weekly as the people using these pools are immersed for longer periods (as are staff) and may be more vulnerable to infection; the presence of the following indicator microorganisms must be monitored:

Test (cfu = colony forming units)	Limit UK	Limit NSW Australia*
Aerobic Colony Count (24 hr 37°C)	Maximum 10 cfu / ml	Maximum 100 cfu / ml
Total Coliforms	Maximum 10 cfu / 100 ml	
<i>E. Coli</i>	Zero in a 100 ml sample	Maximum 1 cfu / 100 ml
<i>Pseudomonas aeruginosa</i>	Zero in a 100 ml sample	Maximum 1 cfu / 100 ml
Legionella (Spa Baths only - quarterly)	Zero in a 100 ml sample	

* The Standards Australia Hydrotherapy Pools AS3979-1993 is available from Standards Australia in each State. Microbiological tests should be performed by laboratories accredited for those tests by the National Association of Testing Authorities (NATA).

- Additionally microbiological tests should be performed:
 - Before a pool is used for the first time or put back into use after being shutdown for repairs.
 - If there are uncertainties with the treatment system or when a risk of contamination is suspected.
 - To validate changes to pool treatment.
- Microbiological analysis should be carried out in appropriately accredited laboratories, e.g. UKAS laboratories, or by competent individuals. Samples should be taken beginning at a depth of 200 mm to 400 mm below the surface of the pool. The pH level and the concentration of Free and Total Chlorine in the pool water should be measured at the same time of the sample collection for the interpretation of the microbiological results. Review of the maintenance records, mechanical failures and water appearance will also be considered.

Aerobic Colony Count (ACC)

ACC also called Total Viable Count, Colony Count or Heterotrophic Plate Count can be high where there is a higher bather load, reduced chlorine residual or where there are defects in water treatment. If a colony count above 10 cfu / ml is the only unsatisfactory microbiological result, and residual chlorine and pH values are within recommended ranges, the water should be retested.

Total Coliforms

Coliforms within swimming pools can be considered as an indication of faecal contamination or poor hygiene. A repeat sample should be taken whenever coliforms have been detected. A coliform count of up to 10 cfu / 100 ml is acceptable provided that coliforms are not found in the repeat sample, Aerobic Colony Count is less than 10 cfu / ml and *E. coli* is not present.

Escherichia coli

The presence of *E. coli* in swimming pool water is an indication that faecal material has entered the pool water from contaminated skin, or from faecal material that has been accidentally or deliberately introduced. A repeat sample should then be taken if *E. Coli* is detected.

Pseudomonas aeruginosa

Pseudomonas aeruginosa can cause skin, ear and eye infections when present in large numbers and outbreaks of skin infections have been linked to swimming pools and spa pools. If the count is over 10 cfu / 100 ml, repeat testing should be undertaken, and the filtration and disinfection processes should be examined to determine whether there are areas within the pool circulation where the organism is able to multiply.

5. Have a contingency plan with remedial actions for hydrotherapy pools

Problem	Possible reasons	Potential remedy
pH too high	Mains water alkaline and hard	Add more acid
	Alkaline disinfectant used	Consider changing to acidic disinfectant
pH too low	Mains water is acidic	Add more alkali
	Acidic disinfectant used	Consider changing to alkaline disinfectant
pH erratic	Water is not sufficiently buffered	Check and adjust total alkalinity
pH difficult to change	Water is too well buffered	Alkalinity potentially too high, test and decrease
Cloudy, dirty water	Bathing load too high	Reduce bathing load
	Filtration inadequate	Check filter, flow rate and backwash
Cloudy, clean water	Hardness salts precipitating out of solution	Check Water Balance index value
	Entrained air or coagulant	Check coagulant dosing Check air release on filters
Water has bad taste and smell, irritation of eyes	High combined chlorine, especially trichloroamines	Shockdose, Superchlorinate
		Maintain free chlorine residual
		Replace part of water
	pH incorrect	Check it and correct if necessary
Gross contamination	<i>E. coli</i> > 10 cfu / 100ml PLUS either: <ul style="list-style-type: none"> • Aerobic Colony Count >10 cfu / ml • <i>P. aeruginosa</i> Count >10 cfu / 100ml 	Pool should be closed Contact your local Consultant for Communicable Disease Control (CCDC - via health authority)
	<i>P. aeruginosa</i> > 50 cfu / 100ml PLUS : Aerobic Colony Count > 100 cfu / ml	

6. Maintain the poolside area

- The poolside area should be cleaned daily with pool water and weekly using a solution containing 200 mg/l of Free Chlorine using appropriate dilution of chlorine-releasing tablets.
- In the event of soiling, the area should be cleaned immediately according to the spillage policy.
- A yearly inspection and maintenance should take place and coincide with pool emptying.

7. Ensure effectiveness of maintenance procedures

- In addition to a daily water testing routine, pool operators are advised to provide monthly analytical results from an independent third party laboratory, which detail the microbiological quality of the water in hydrotherapy pools and spas.
- The following points should be recorded and monitored:
 - Appearance of the water at the beginning of each day with respect to colour and turbidity
 - Number of patients treated in the pool at each session should be recorded
 - Patients should not stay in the pool for more than one hour session to be divided into three 15-minute treatment sessions with a 5-minute break between each
 - Incidents of pool soiling and remedial action taken
 - Health complaints by staff or patients
 - The water testing kits used for measuring chlorine and water balance should be kept in a good state of repair. When using a photometer, only the recommended cuvettes should be used; and the testing performed in one designated area that has constant incident light if used indoors without the cap, to avoid interferences on the photodiode.
Learn more [here](#)
 - Daily maintenance and regular engineering inspections
 - Back flushing should occur frequently to maintain water quality

Further readings

Guidelines on managing hydrotherapy suites

- While there are no specific health and safety regulations governing swimming pools, hydrotherapy pools and spas, p 15 to 41 of [HSE document HSG179](#) (Managing Health and Safety in Swimming Pools) summarise the health and safety legislation with which all pool operators must comply in the UK.
- Extract from BSI Code of Practice PAS39:2003 UK Pool Water Treatment Advisory Group <http://www.pwtag.org/INFO%20codeofpractice.php>
- Guidelines for Environmental Infection Control in HealthCare Facilities  (pages 67-69) from CDC and the Healthcare Infection Control Practices Advisory Committee (HICPAC). More information on hospital-based recommendations for medical uses of water is found at CDC's Infection Control Guidelines (Division of Healthcare Quality Promotion) http://www.infectioncontrolservices.co.uk/hydrotherapy_intro.htm
- Swimming Pool Microbiological Testing Frequency – NSW Health, Australia <http://www.health.nsw.gov.au/environment/factsheets/Pages/swimming-pool-microbiology.aspx>
- Microbiological and Chemical Exposure Assessment Development and validation of a same-day monitoring method for recreational water – US Environmental Protection Agency <http://www.epa.gov/nerlcwww/research/recreationalwater.html>

Benefits from Hydrotherapy

- <http://www.spaevidence.com/spaevidence/hydrotherapy/research?learn-more=1>
- <http://www.arthritisresearchuk.org/arthritis-information/therapies/hydrotherapy/accessing-hydrotherapy.aspx>
- <http://www.csp.org.uk/professional-networks/atacp>
- <http://www.hydroworx.com/research-education/research-studies/>

Please just contact support@palintest.co.uk if you have any questions or require more information.

Find out more information in the **Know** area of our website.