Ultrafiltration Programs: Clinical Experiences

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Ultrafiltration Programs : Clinical Experiences

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Introduction

The purpose of this article is to provide information about the ultrafiltration profiles available on the B. Braun Dialog® machine. The information is based on the experience and observations of the authors. No clinical results or measurements were conducted to compare patient treatments with and without the use of UF profiles.

Ultrafiltration (UF) is the process by which fluid and some solutes are removed from the patient through the process of filtration under pressure. The Dialog hemodialysis system provides several UF programs that vary the percentage of UF at designated time intervals. Some patients shift fluids easily while other patients do not. Underlying medical conditions such as diabetes or cardiovascular disease may contribute to a slower or uneven shift of fluid from the tissues to the blood vessels. The patient may experience episodes of hypotension at various times throughout the treatment. These hypotensive episodes may be reduced and possibly eliminated by varying the UF rate throughout the treatment.

The Ultrafiltration programs included with the Dialog machine are designed to optimize the safety and comfort of the patient during dialysis therapy. The programs automatically increase and decrease the UF rate at various time segments during the therapy while maintaining the absolute UF goal.

Instructions for activating and monitoring the UF programs may be found in the Dialog Operators manual. Instructions for modifying UF programs are included in the Dialog service manual. Please contact B. Braun Medical (800-621-0445) if you have any questions about UF programs.

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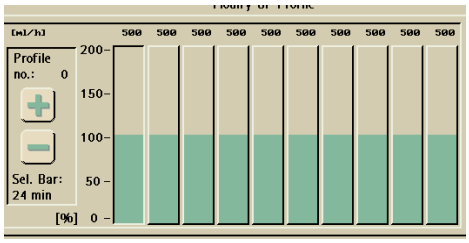
ULTRAFILTRATION PROGRAMS
Suggested Scenarios for Use

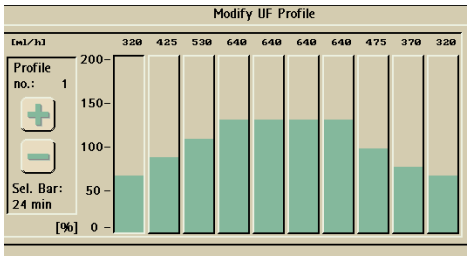
I. DIFFUSIVE PROFILES
Removal of fluid through ultrafiltration; Diffusive clearance through Dialysate flow through the dialyzer

Program 0 (Default Profile)



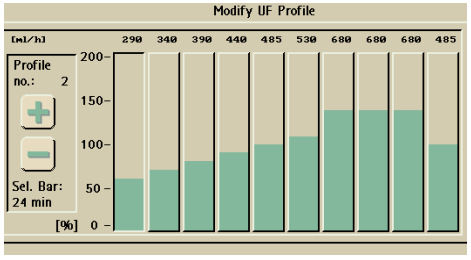
Used for low or high weight gainers when the minimum or maximum UF alarm limit would be exceeded during a high or low segment of other programs. Offers a constant steady pull of fluid throughout the therapy.

Program 1



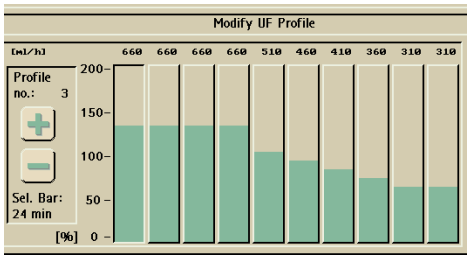
Used when a gradual increase in UF rate is required at the beginning of therapy (example: patient drops blood pressure, becomes nauseated/vomits) or when the patient drops blood pressure toward the end of therapy. Also helps if the patient tends to cramp toward the end of therapy.

Program 2.



Used more in the acute setting when the patient is unstable and is to receive osmotics such as blood or albumin at the onset of therapy. Ultrafiltration is delayed until the patient has the osmotic on board. NOT recommended for the chronic patient who is likely to cut his therapy short.

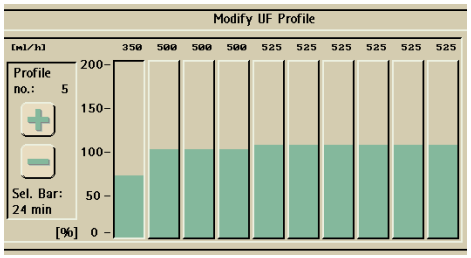
Program 3



Used for the patient who is volume-overloaded with shortness of breath at the onset of therapy; or, for patients who have a tendency to drop their blood pressure toward the end of therapy.

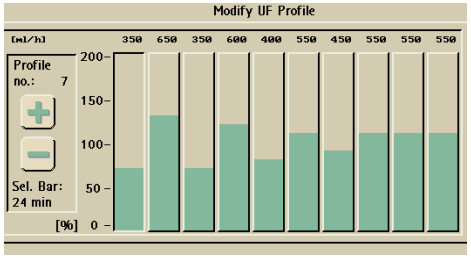
This profile is a favorite of most patients as they have a tendency to feel more energetic at the end of therapy. The machine pulls the majority of fluid during the first 40% of therapy when the patient has the most to give; the body adjusts to the lower fluid volume during the remainder of the therapy when diffusion and less ultrafiltration is taking place.

Program 5



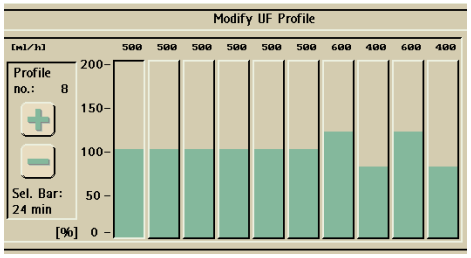
Used for patients who benefit from a gentle increase in ultrafiltration, or for patients who have a tendency to drop their blood pressure at the onset of dialysis.

Program 7



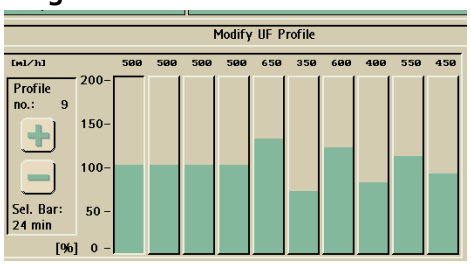
Used for patients who have difficulty shifting fluids freely from the tissues into the vascular space (diabetics, cardiovascular compromised, and elderly patients). Some patients have difficulty at the beginning of therapy. These patients usually drop their blood pressure randomly throughout the treatment. With the Dialog® machine it is possible to customize this program by altering segments toward the end of the treatment to establish a pattern that increases and decreases the UF pull throughout the entire treatment. This works beautifully for the diabetic patient.

Program 8



Used for patients who have a tendency to drop blood pressure during the last 40% of treatment. Also helpful for those patients who complain of mild cramps in their fingers and toes at the end of therapy.

Program 9

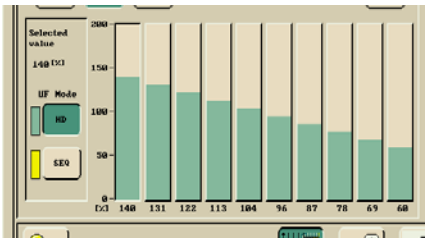


Used for patient who have a tendency to cramp or drop blood pressure toward the end of therapy (last 60%) when they do not have as much fluid on board so that the shift of fluid is not as rapid. The increased ultrafiltration is followed by a decrease in pull of fluid that allows the patient time to shift the fluid from the tissues to the vascular space.

Program 10

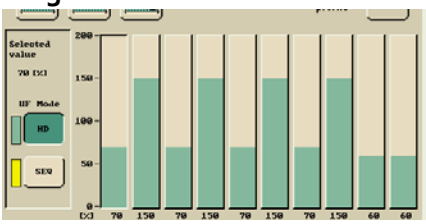
Identical to Program 0.

Program 11



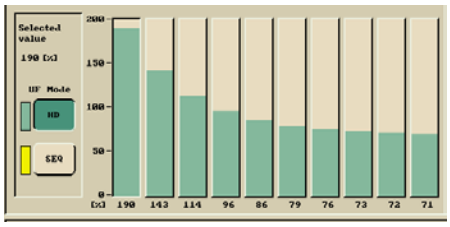
Linear profile with more UF at the beginning. This is used for patients who can tolerate more fluid removal at the beginning of the therapy with a gradual decrease to a lower amount at the end. Ideal for patients who drop their blood pressure at the end or who tend to cramp at the end of therapy.

Program 12



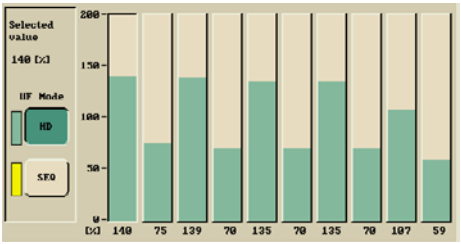
Used for patients who have difficulty shifting fluid freely from the tissues into the vascular space (i.e. diabetics, cardiovascular compromised and elderly patients). This profile starts off by taking a small amount of fluid off to be gentle at the beginning then it alternates (every 10% of the therapy) between high UF to low UF.

Program 13



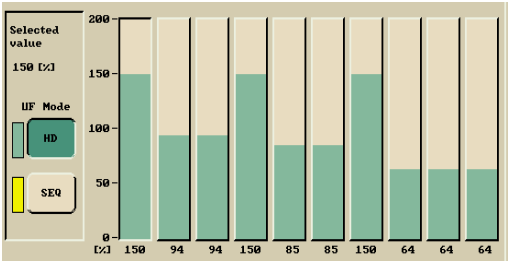
Exponential UF profile. This profile starts off by taking a large amount of UF during the first 10% of therapy then rapidly drops down to a lower UF. Ideal for patients who can tolerate a large fluid removal at the beginning. Good for patients who tend to drop their pressure in the middle and at the end of therapy.

Program 14



Used for patients who have difficulty shifting fluid freely from the tissues into the vascular space (i.e. diabetics, cardiovascular compromised and elderly patients). This profile starts off by taking a large amount of UF then alternates every 10% of therapy between low UF and high UF. Patients tend to tolerate this profile very well, especially those who cramp and drop their blood pressure randomly throughout the treatment. Patients often comment that they feel much better after this UF profile.

Program 15

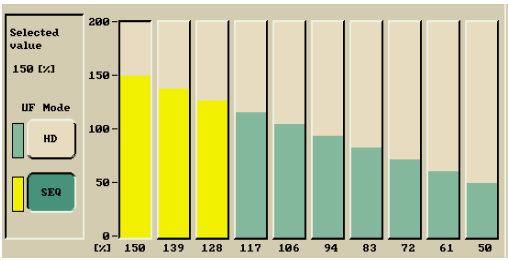


Used for patients who have difficulty shifting fluid freely from the tissues into the vascular space (i.e. diabetics, cardiovascular compromised and elderly patients).
This profile can be used for the more unstable patient. This profile has a high UF at the first 10% of treatment then low UF for the next 20% of treatment. This is alternated throughout the therapy.

II. COMBINATION PROFILES

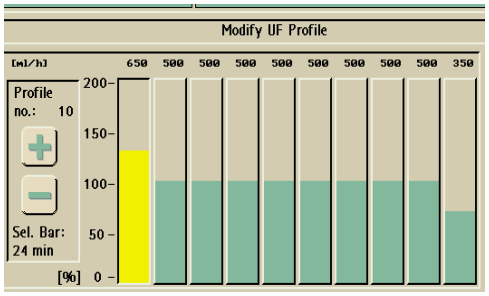
SEQUENTIAL (Yellow Segments): ultrafiltration <u>WITHOUT</u> diffusion.
DIFFUSION (Green Segments): ultrafiltration <u>WITH</u> diffusion.

Program 17



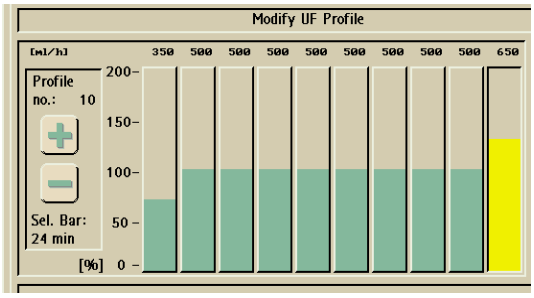
Linear UF profile with the first 30% in sequential mode ((ultrafiltration without diffusion). Used for a patient who is fluid overloaded and needs to pull a majority of their fluid at the beginning in the Sequential mode.

Program 4



Designed to allow sequential dialysis (ultrafiltration without diffusion) for the first 12% of therapy followed by regular dialysis (ultrafiltration with diffusive clearance). Used for patients who present with shortness of breath at the onset of dialysis; or, for fluid overloaded patients who need a higher UF at the beginning of therapy. The treatment time is usually increased to accommodate for the decreased time of diffusion.

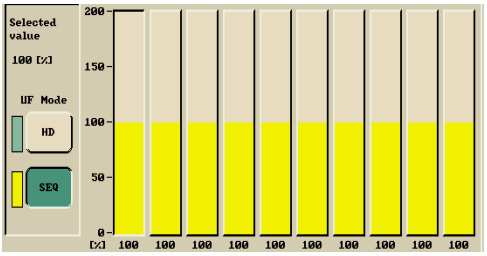
Program 6



Used for patients who require additional fluid removed, but who cannot withstand a large volume at the onset of therapy; or, who have a high potassium level and the clinician does not want to dry the patient out too quickly which could increase the potassium level in the blood. Sequential dialysis (ultrafiltration without diffusion) is performed the last 12% of the therapy.

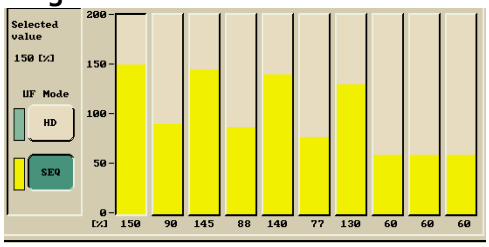
III. SEQUENTIAL PROFILES
Ultrafiltration without diffusion

Program 16

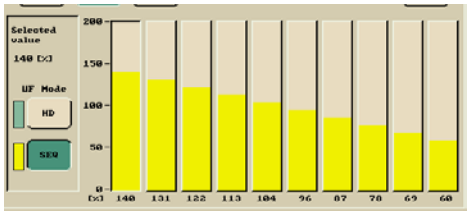


All sequential (ultrafiltration without diffusion) straight across. This is used for the patient who tends to have a stable blood pressure throughout the entire treatment. Used for low or high weight gainers when the minimum or maximum UFR would be exceeded during one of the high or low segments of other programs. Offers a constant steady pull of fluid throughout the therapy.

Program 18



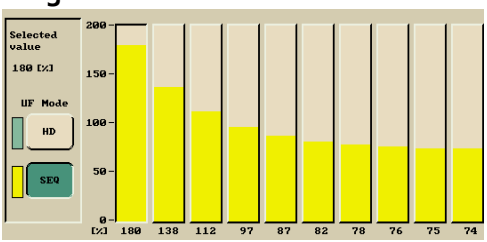
This profile is all in sequential mode (ultrafiltration without diffusion). Used for patients who are in fluid overload and have difficulty shifting fluid freely from the tissues into the vascular space (i.e. diabetics, cardiovascular compromised and elderly patients). This profile starts off by taking a large amount of UF then alternates every 10% of therapy between low UF and high UF. Patients tend to tolerate this profile very well, especially those who cramp and drop their blood pressure randomly throughout the treatment. Patients often comment that they feel much better after this UF profile.



Program 19

This profile is all in sequential mode (ultrafiltration without diffusion). Linear profile with more UF at the beginning. This is used for patients who can tolerate more fluid removal at the beginning of their therapy and then it is tapered down to a less amount at the end. Ideal for patients who drop their blood pressure at the end or who tend to cramp at the end of therapy.

Program 20



This profile is all in sequential mode (ultrafiltration without diffusion). Exponential UF profile. This profile starts off by taking a large amount off during the first 10% of therapy then rapidly drops down to a lower UF. Ideal for patients who can tolerate a large fluid removal at the beginning. Good for patients who tend to drop their pressure in the middle and at the end of therapy.

Programs 21-30: The dialysis unit can customize their own UF profiles. Refer to the Dialog Service Manual for instructions.

B|BRAUN
SHARING EXPERTISE

The Use of Cyclical Ultrafiltration Models in Hemodialysis

Jennifer A. White, RN, BSN, CNN

To optimize the efficiency of fluid removal during dialysis, and to increase patient comfort and stability, it is important to understand the dynamics involved in fluid shifts. The B. Braun Dialog® Plus hemodialysis system allows the operator to choose ultrafiltration (UF) profiles that will assist in comfortable and safe fluid removal.

Review of fluid pressures

There are four primary factors which determine whether fluid will move out of the blood into the interstitial space, or in the opposite direction. These factors are:

1. Capillary pressure
2. Interstitial fluid pressure
3. Plasma colloid osmotic pressure
4. Interstitial fluid colloid osmotic pressure

Capillary pressure:

Increased pressure within the capillaries causes fluid to move from the intravascular space into the interstitial space. Capillary pressure may be increased in the dialysis patient from fluid overload, secondary to increased oral fluid intake and/or increased intake of sodium.

Interstitial fluid pressure:

If the pressure of the fluid in the interstitial space is higher than that of the capillary pressure, it will cause fluid to move into the intravascular space.

Plasma colloid osmotic pressure and interstitial fluid colloid osmotic pressure:

It is normal for very small amounts of protein to diffuse out of the plasma into the interstitial space. When these proteins move into the interstitial space, they are quickly removed via the lymph system. The concentration of proteins in the plasma, therefore, averages about four times that in the interstitial fluid.

Changes in fluid dynamics specific to the dialysis patient

In the dialysis patient, several factors can change the normal fluid dynamics.

1. Low levels of serum albumin are common; therefore, the plasma colloid osmotic pressure is lower than normal. This results in less incentive for fluid to move into the intravascular space.
2. Patients, at times, have large interdialytic fluid gains. The intravascular space becomes overloaded which increases the capillary pressure, forcing more fluid into the interstitial space.
3. Many patients have compromised cardiac function, resulting in sluggish capillary flow, which also increases capillary pressure.

Issues in Ultrafiltration

In many patients fluid removal is performed using high UF in the beginning of a treatment, with gradually decreasing UF either in a step or linear model. The theory behind this has been to ultrafilter aggressively early in the treatment when the patient has the most fluid to remove. This pattern can have good results, especially in younger patients or those without cardiac disease.
However, high UF early in the treatment can cause depletion of intravascular volume which cannot be made up quickly. This may be exacerbated by the above-mentioned vascular and nutritional factors, and result in blood pressure drops which are difficult to reverse. With unstable blood pressures, the staff may decrease the ultrafiltration goal, the patient may end the treatment above his dry weight, and the cycle of fluid overload will continue.

An alternative to this model is to ultrafilter the patient using cyclical periods of higher and lower UF pressures.
The Dialog® Plus hemodialysis system has 6 of these ultrafiltration profiles, with varying patterns. Each of these is illustrated within the enclosed reference article; Ultrafiltration Programs : Clinical Experiences, RTD.TR02 1/05, (profiles number 7, 8, 9, 12, 14, and 15).
During cyclical "rest periods" in ultrafiltration, the UF rate is decreased, and the intravascular space has a chance to refill, since the interstitial fluid pressure can be presumed to be, transiently, greater than the capillary pressure.
Each time that this cycle occurs, more fluid is moved back into the intravascular space, allowing the patient's blood pressure to rebound.
It has been noted anecdotally in clinical practice that the use of UF profiles incorporating "rest periods" has resulted in patients being able to reach their actual dry weights more comfortably. There are fewer episodes of hypotension and muscle cramping.

References:

Basic Human Physiology: Normal Function and Mechanisms of Disease, Arthur C. Guyton, M.D.
Chapter 16, Capillary Dynamics; Interstitial Fluid, and the Lymphatic System

Pathology, a Dynamic Introduction to Medicine and Surgery, Second Edition, Thomas M. Peery, M.D., and Frank N. Miller, M.D.
Chapter 2, Circulatory Disturbances

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