# Overview of FIR Therapy for HD Vascular Access

## FIR Therapy reduced AVF malfunction by 58% in a 1-yr. clinical study

*Adapted from:* **CC Lin et al, *Journal of American Society of Nephrology* 2007;18(3):985-992**

***RESULTS**: When compared with controls,* the FIR group experienced*:*

- **58.4% REDUCTION** in **AVF malfunction rate**
- **27% IMPROVEMENT** in **AVF unassisted patency**
- Significantly lower incidence of AV fistula malfunction (1 episode per 67-7 patient months vs 1 episode per 26-7 patient months.) P=0.03

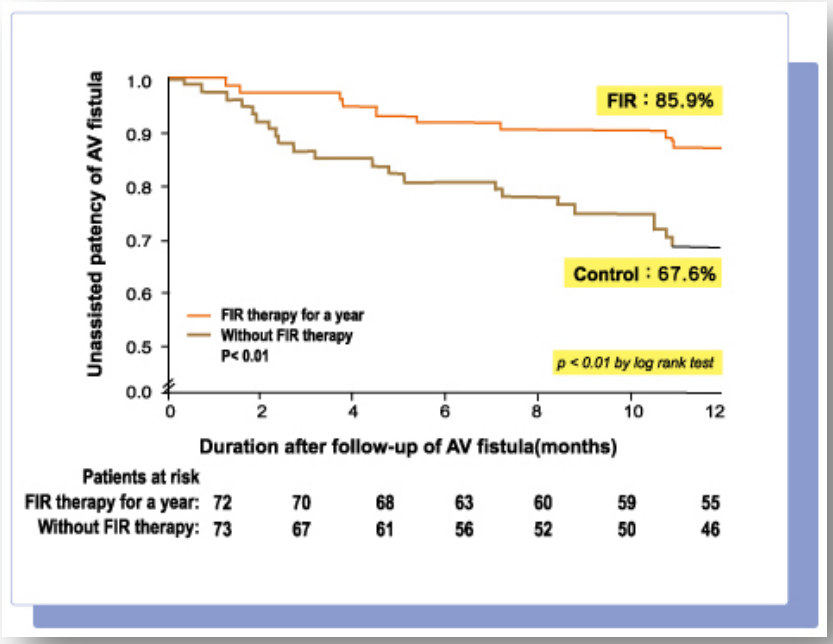


*Figure:* Comparison of 1-year AV fistula survival[1]

## FIR Therapy stimulates production of potent anti-inflammatory agents such as heme oxygenase (HO-1), and effectively reduces inflammatory markers created during HD.

- ***RESULTS:*** **This anti-inflammatory cascade reduces endothelial dysfunction, inhibits neointimal hyperplasia, and lowers oxidative stress. It also increases access blood flow and angiogenesis.**[1-7]
- ***DETAILS:*** Clinically, FIR Therapy has been found to lower the increase of inflammatory markers induced by hemodialysis; such as hypersensitive C-reactive protein (hsCRP), soluble ICAM-1 (sICAM-1), soluble VCAM-1 (sVCAM-1), and asymmetric **dimethylarginine (ADMA).**[2, 5]
- ***ICAM-1 protein*** is an intercellular adhesion molecule. Upon cytokine stimulation, its concentrations in the membranes of leukocytes and endothelial cells greatly increase. ICAM-1 can be induced by interleukin-1 (IL-1) and tumor necrosis factor alpha (TNFα) and is expressed by the vascular endothelium, macrophages, and lymphocytes. **VCAM-1 protein** mediates the adhesion of lymphocytes, monocytes, eosinophils, and basophils, to vascular endothelium. It also functions in leukocyte-endothelial cell signal transduction, and it may play a role in **the development of atherosclerosis** and rheumatoid arthritis.
- ***ADMA*** is an endogenous molecule which acts as an inhibitor of nitric oxide (NO) synthesis, and NO produced in endothelial cells is a vasodilator and antithrombogenic agent. Therefore ADMA has been studied extensively, and an elevated level of ADMA is shown to be a marker for **impaired endothelial function** and **cardiovascular risk**.

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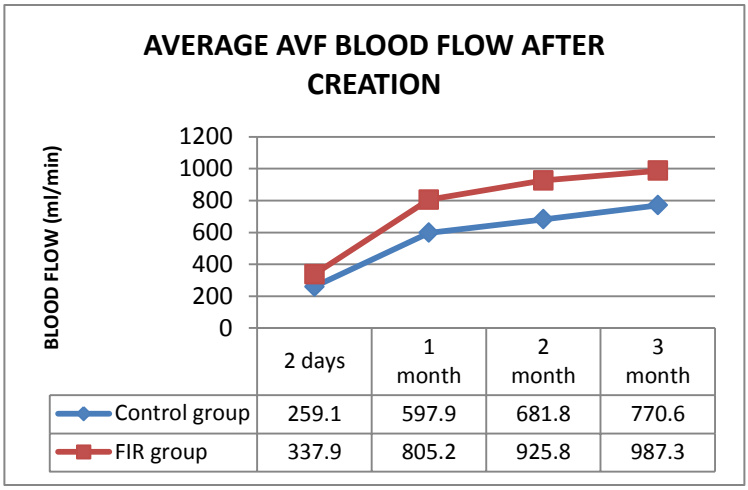
## FIR Therapy Research:

### Access flow, AVF maturation, Surgical intervention Rates




- **Lin CC et al 2007.** In a clinical study of CKD patients with end stage kidney disease (ERSD),[1] one group was given 40 mins. of FIR therapy 3x/ wk., for 1 year during AVF hemodialysis. Compared to controls, the FIR group's blood flow increased more significantly after 1 x 40-minute treatment, and continued to improve for a year. After one year, blood flow of the FIR group had *increased* by 6.8 % compared to the control group without FIR therapy, whose blood flow in a year, had *reduced* by 5.2%.

- **Bashar K et al Meta-analysis 2014:** In a review of 4 RCTs using FIR therapy with ESRD patients 40 minutes day during dialysis, 3 times a week for a year, this study found that **the FIR therapy group achieved a 51% reduction in surgical interventions to save a threatened fistula** compared to controls. They also found that "FIR therapy was shown to have **improved access flow** and a **one year effect of increasing AVF patency by about 18%** over controls" [1,6-8]

- **Now approved in 6 Asian countries and in the EU, FIR is used for HD in the UK's National Health Service and is standard vascular access care in Taiwan:** "**This novel non-invasive therapy** has become a standard of access care in Taiwan since 2007, where it is being **used in 90%** of the dialysis centers. **FIR Therapy has been proven to improve vascular access care and to reduce the economic impact of ESRD"** **Dr. Yuh-Feng Lin, Taiwanese Society**


**References:**

1 Lin C-C, Chang C-F, Lai M-Y, Chen T-W, Lee P-C, Yang W-C. Far-infrared therapy: a novel treatment to improve access blood flow and unassisted patency of arteriovenous fistula in hemodialysis patients. *Journal Of The American Society Of Nephrology: JASN.* 2007;18(3):985-992.

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3 Rau C, Yang J, Hsieh C, et al. Far-Infrared Radiation Promotes Angiogenesis in Human Microvascular Endothelial Cells via Extracellular Signal-Regulated Kinase Activation. Photochemistry And Photobiology [serial online]. n.d.;87(2):441-446.

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7. Lin CC, Yang WC, Chen MC, Liu WS, Yang CY, Lee PC. Effect of far infrared therapy on arteriovenous fistula maturation: an open-label randomized controlled trial. *Am J Kidney Dis.* 2013 Aug; 62(2):304-11

8. Bashar K, Healy D, Brown LD et al. Role of far infrared therapy in dialysis arterio-venous fistula maturation and survival: Systematic review and meta-analysis. *PLos ONE*. 2014.9(8): e104931. doi:10.1371/journal.pone.0104931