

Gut Treatment Protocols: Leaky Gut - Part Two

Prebiotics, as I mentioned, may have beneficial effects above and beyond short-chain fatty acid production. Galacto-oligosaccharide, or GOS, protects against salmonella infections and against barrier impairment in experimental pancreatitis. Fructo-oligosaccharides, or FOSs, have been shown to attenuate experimental hepatic steatosis, fatty liver, possibly by modulating the intestinal microbiota, or the intestinal barrier function, or both, so again we're going to talk about specific strategies with fermentable fiber and prebiotics in a subsequent section.

Probiotics have also been shown to improve barrier function. *E. coli* Nissle 1917, or Mutaflor, which we've talked about before, the probiotic that's available from Germany, was shown to prevent barrier disruption caused by infection of intestinal cells with an enteropathogenic *E. coli* strain. Administration of *Lactobacillus plantarum* in VSL#3 and products like VSL#3 and Ideal Bowel Support into the duodenum of healthy human volunteers was shown to significantly increase tight junction function and improve barrier integrity, and then *Saccharomyces boulardii* has been shown to restore barrier integrity, according to lactulose/mannitol tests.

Glutamine is a major fuel and important nitrogen source for small intestinal cells and plays a key role maintaining mucosal cell integrity and gut barrier function. Some studies have shown that glutamine is effective in restoring gut barrier integrity, either as a glutamine supplement or in things like whey protein. It increases claudin-1 expression in the colonic mucosa in patients with IBS diarrhea. Another study found both glutamine and whey significantly improved intestinal permeability and morphology. However, other studies, particularly in patients with Crohn's disease, have shown no benefit with glutamine. The dose varies considerably, but it is usually really high, can be 20 to 40 grams per day. Maybe one half-gram per kilogram of body weight would be a good therapeutic dose to start with. Note that high doses of glutamine can cause constipation. My results with glutamine overall have been somewhat lackluster; we stopped using it for a period of time, we've been experimenting with using it again. It's not something that really stands out in terms of one of the more effective therapeutic interventions, at least in my experience. If you do choose to try glutamine, I like GlutImmune from Well Wisdom as an option there. It's a powder; it can be easily added to other foods or mixed with water. They recommend mixing with water or consuming on an empty stomach if I recall, but I'm not sure there's a lot of research to support that difference between taking it with food or on an empty stomach.

Colostrum—it protects against NSAID-induced permeability in rats. There's unfortunately little research on its effect in humans, so I wouldn't really put it high on the list. However, to get the benefits of both colostrum and glutamine, you can use a high-quality bioactive whey protein powder. ProSerum is one brand that I'd recommend. It's a native whey protein that's produced to maintain the full range of all of the fragile immune-modulating and regenerative components that are naturally present in fresh raw milk, and it's made from pasture-raised cows, no antibiotics or

hormones, and ProSerum is a brand of whey that is used in a lot of different higher-quality protein powder products, so you can generally look at the label of a protein powder and it will say ProSerum on it, and then you know that it's typically a good choice.

Lubiprostone is a new drug; it's a chloride channel activator that's being used for constipation-predominant IBS. It has a prokinetic effect and it also improves barrier function in some studies. It's pretty new. I don't have any experience with it, so I can't make specific recommendations, but if you're a physician and you see a lot of patients with this IBS-C presentation, you may want to investigate it and consider it.

Elemental diet for **intestinal permeability**

79%
remission

If severe intestinal permeability doesn't respond to anything else, elemental diet can be very effective here. In one study, 27 of 34 patients with inflammatory bowel disease, which is, of course, characterized by intestinal permeability, achieved remission with an elemental diet, that's 79 percent, probably one of the most effective treatments for inflammatory bowel disease with the lowest risk. And in that study, they actually measured markers of intestinal permeability and observed that they improved significantly. So one thing with the elemental diet that I want to point out is the reason that it works is that it contains only foods that are absorbed extremely high up in the small intestine, so it gives the gut kind of a total rest, and that's what reduces the inflammation and reduces the permeability because the enterocytes of the cells in the small intestine regenerate on their own every three days, so if they aren't being triggered by food, then they can heal very well on their own.

But the issue with the elemental diet, and the reason it's so effective, is also the reason that it can be problematic because it will completely starve the beneficial bacteria in the colon as well. With the increasing amount of research pointing to the importance of the beneficial microbiota in the colon and correlating reduced species richness and diversity in the colon with risk for many, many different diseases, I have some reservations with the elemental diet. On the other hand, that has to be balanced with the seriousness of inflammatory bowel disease and the inflammation and

problems that that causes, so I think on balance, if nothing else is working, the elemental diet is worth a try in patients that have that kind of severe inflammation and IBD presentation.

Interventions to restore intestinal barrier integrity	
Intervention	Notes
Elimination diet	Run Cyrex Arrays 3, 4 & 10 and remove positive/equivocal foods
Vitamins A & D	Best obtained from high-vitamin cod liver oil
Zinc	Very high dose (110 mg TID) required; 8 week maximum duration, don't do long term!
Butyrate/SFCAs	3-4 g/d of sodium-potassium butyrate, and/or prebiotics and fermentable fiber
Probiotics	E. coli Nissle 1917, L. plantarum, S. boulardii, SBOs, transient commensals
Glutamine or whey	20-40 g/d of glutamine, and/or bioactive whey if tolerated (whey has colostrum too)
Lubiprostone	May be particularly useful in IP w/ constipation
Elemental diet	For severe IP that doesn't respond to anything else

Okay, so here's a summary of the various interventions to restore intestinal barrier integrity, and we'll have this as a handout for you: elimination diet; Cyrex Array 3, 4, and 10; vitamins A and D; zinc, but it has to be a very high dose, 110 milligrams three times a day, I would say eight weeks maximum duration there and I wouldn't recommend doing it long term, and you may also want to have them supplement with a little bit of copper while they're doing that; short-chain fatty acids, in particular butyrate, so three to four grams of sodium potassium butyrate and/or prebiotics and fermentable fiber to increase butyrate production. Probiotics you could consider would be E. coli Nissle 1917, Lactobacillus plantarum, Saccharomyces boulardii, soil-based organisms like Prescript-Assist or transit commensals like MegaSporeBiotic. Then you've got glutamine or whey, so it could be 20 to 40 grams per day of glutamine, which is an extremely high dose that's been used in some studies. I think you'd have to really watch out for constipation in those cases, and/or a bioactive whey protein powder, which also contains colostrum, that's been shown to have some benefit, at least in a few animal studies. Then we have lubiprostone, which is a new drug that's being investigated for intestinal permeability with constipation; and finally, we have the elemental diet for severe intestinal permeability that doesn't respond to anything else.