

Brain Injury & Recovery of Function with Reference to Hyperbaric Oxygen

Excerpt from Dr. Philip James MD. Scotland

After brain injury, many blood capillaries around the area of injury become torn. The blood plasma then leaks out causing swelling in the surrounding brain tissue, squeezing it like a sponge and so reducing blood flow and therefore nutritional supply. Without this essential nutrition, the brain's electrical activity becomes diminished and signals can not be effectively rerouted. Unfortunately the tiny tubules leading to the capillaries also become so constricted that the red blood cells can not get through to heal the torn capillary walls. Hyperbaric Oxygen treatment is the giving of oxygen under increased atmospheric pressure, (i.e. above the one atmosphere at which we all live) which dramatically increases the oxygen carried in the blood plasma. The treatment is carried out in a Hyperbaric Oxygen Chamber. In this way, oxygen becomes available to heal the capillary walls, so preventing plasma leakage and reducing swelling. As the swelling decreases, normal blood flow is restored to the surrounding tissue and the cells electrical activity recommences.

The Problem

1. The complex and almost continuous electrical activity of the brain is so discreet that we are unaware that it is the mechanism behind communication and thus intellectual and motor function.
2. Brain injury can lead to a blockage of the electrical pathways.
3. Depending on the location of the injury, the brain's attempts to re-route through blocked pathways may cause frustrated discharges of activity known as seizures.

What Causes the Blockage ?

SPECT scans (computerized brain mapping) show that not only does brain injury produce cell death, but also it reduces essential blood flow to a wider area of brain tissue surrounding the dead cells, where signal re-routing might be expected to take place.

How does this happen ?

1. After brain injury many blood capillaries around the area of cell death become torn open.
2. The liquid part of the blood (the plasma) then leaks out causing a swelling which may be very extensive.
3. This reduces cerebral blood flow in the affected area.
4. Reduction in blood flow means a reduction of essential nutrition (most vitally oxygen), and a build up of waste products from local biochemical reactions (eg lactate and calcium), which shut down normal cell function and further block pathways.

Why doesn't Capillary Healing happen ?

1. If the capillaries are to heal they desperately need oxygen.
2. Unfortunately, the tiny tubules leading to the torn capillaries become constricted because of the damage.
3. This means that the red blood cells needed to bring the healing oxygen are too big to get through and simply get stuck in the pipes.

RESCUE

What does Hyperbaric Oxygen Therapy do ?

1. It is a scientific fact that, whereas we all live under atmospheric pressure (ie one atmosphere), gases dissolve increasingly into liquids as atmospheric pressure increases.
2. This can be seen each time you release bubbles by unscrewing a bottle of fizzy drink, as the pressure is reduced more bubbles seem to appear from the water.
3. Although blood plasma is normally quite low in oxygen, on high pressure days people usually feel more energetic because a little more oxygen has been dissolved in the blood plasma. Conversely, many people feel their complaints are worse on a low pressure day.
4. If additional oxygen is urgently needed to restore torn tissue, increasing the dose may be paralleled to increasing the dose of vitamins, minerals or amino-acids by food supplementation or by giving an artificially engineered 'normal' dose of insulin to a diabetic.
5. It is impossible to absorb the extra oxygen by breathing it in at normal atmospheric pressure because insufficient can be dissolved in the blood plasma at only one atmosphere.

6. Thus, in order to improve cerebral blood flow, the brain injured individual needs to sit or lie comfortably in a pressurized chamber breathing oxygen through a mask (or a lightweight transparent hood).

7. The ideal pressure for the compressed air in the chamber, and the oxygen breathed, is 1.75 atmospheres - that is 3/4 of an atmosphere above the one atmosphere at which we all live - the equivalent of 24ft of sea water - a relatively shallow depth.

8. As oxygen delivered in this way is breathed the blood plasma becomes oxygen rich.

9. It is thus able to carry the healing oxygen through the constricted capillary tubules to the torn capillary walls which will then begin to heal.

10. As the capillaries heal, their torn walls close and plasma leakage into the surrounding brain tissue stops.

11. Tissue swelling is reduced even more efficiently because oxygen has a slightly constricting effect on blood capillaries.

12. Thus, when blood plasma is oxygen rich, there is also less fluid to contribute to the swelling traveling through the torn capillaries as well as more oxygen to heal them.

13. The swelling gradually goes down and normal blood supply is slowly restored to the previously waterlogged brain.

14. Normal blood supply restores essential nutrition and the washing away of waste products so that the brain's electrical potential for sending normal signals can be restored.

Wherever the injury is in the brain, and whatever diversity of symptoms it produces, the same patterns of problem arise, and the same approach to healing is possible using hyperbaric oxygen therapy.

References:

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