

Third, HA appears to be equivalent to steroids in the treatment of arthritis [Drugs 47: 536-66 1994] without all of the side effects produced by steroids (poor wound healing, cataracts, glaucoma, many others).

COMBINATION NATURAL JOINT THERAPY

One researcher has suggested an extensive regimen of food supplements that would include niacinamide, glucosamine, SAMe, fish oil and selenium in the treatment of osteoarthritis. [Medical Hypotheses 53: 350-60, 1999]

CHAPTER SEVEN

HA and the Eyes

The eyes are one of the organs with very high concentrations of HA. HA plays a major role in maintaining the health of the ocular tissues such as the cornea (clear front window of the eyes), the retina, the vitreous gel that fills most of the eye, and the drain (trabecular meshwork) that maintains fluid pressure inside the eye. The high HA content of the human eye may explain why the provision of oral HA supplements has been reported to have profound effects upon vision in some people.

All of the factors that can break down HA can come into play in the human eye. Since the human eye is transparent to light, solar ultraviolet radiation can attack the cornea on the surface of the eyes as well as the inner eye structures such as the lens, vitreous gel and retina. Riboflavin, vitamin C and potentially toxic metals such as iron and copper are all found in eye tissues. In a test tube, German scientists grew retinal tissue and exposed it to high levels of riboflavin, iron and ultraviolet radiation. The combination inhibited the growth of retinal nerve cells. [Free Radical Biology Medicine 24: 798-808, 1998]



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HA AND THE FLUID DRAIN (GLAUCOMA)

The common form of glaucoma has been called an HA deficiency. [Medical Hypotheses 51: 483-84, 1998] Glaucoma, which affects the eyes of about 2 percent of the total population, but as much as 8 percent of aged adults, is characterized by poor outflow of aqueous fluid from the inner portion of the front of the eye which then builds up pressure and may pinch off the branch-like network of optic nerves at the back of the eyes. This can result in narrowed side vision. Conventional treatment of glaucoma with medications, that reduce the flow of aqueous fluid, can effectively reduce intraocular pressure but may induce cataracts and other side effects. So a preventive measure would be welcome.

The link between a shortage of HA and glaucoma is compelling. Aqueous fluid drains out of the eyes through a mesh-type filter composed of collagen. There is less HA in the fluid drain of aging eyes. [Z Gerontol 23: 133-35, 1990]

In 1996 researchers examined the eyes of recently deceased aged individuals. The normal fluid drain of the eye (trabecular meshwork) of individuals who had glaucoma had 77 percent less hyaluronic acid than normal eyes. Six of ten eyes examined had no detectable HA whatsoever. [Investigative Ophthalmology 37: 1360-67, 1996] This is compelling evidence that a shortage of HA in the human eye is linked with age-related eye disorders.

The aqueous fluid of adult eyes may contain five times more HA than the fluid obtained from children. [Current Eye Research 16: 1069-71, 1997] This probably means that more HA is being lost with advancing age and is being washed from the eyes.

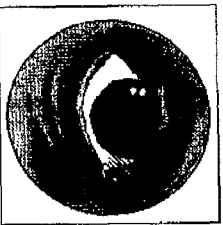
The cells in the fluid drain of the eyes produces less HA among glaucoma patients. The addition of vitamin C to these cells stimulates the production of HA. [Z Gerontol 26: 243-46, 1993]

Vitamin C may be an antidote to this problem. Aqueous fluid is normally high in vitamin C. When additional vitamin C is added to aqueous fluid in a laboratory dish, HA production is elevated. [Z Gerontology 26: 243-46, 1993]

In hypothyroidism the abnormal accumulation of HA residue in the fluid drain of the eye may result in poor outflow and elevated fluid pressure. A rise in eye fluid pressure has been reported in a hypothyroid patient who discontinued thyroid hormone medication. [J Am Optometric Assoc 67: 109-14, 1996]

It is known that steroids can raise the fluid pressure in the eye. It has been shown that steroids impair the production of HA in eye tissues. [Experimental Eye Research 64: 539-43, 1997]

Eye surgeons have successfully placed a net-like HA implant into the eyes of patients with advanced forms of glaucoma. This HA implant is a very hopeful new anti-glaucoma therapy. [Journal Cataract Refractive Surgery 25: 332-29, 1999]



The common form of glaucoma is believed to be caused by a deficiency of hyaluronic acid.

HA AND THE OPTIC NERVE

Chondroitin sulfate is the major support collagen for the optic nerve. [Investigative Ophthalmology 35: 838-45, 1994] Research studies show that HA is virtually

absent from the insulation (myelin sheath) that surrounds certain types of optic nerve bundles among patients with glaucoma (open-angle). Decreased amounts of HA may make the nerves prone to damage from elevated fluid pressure in the eye. [Experimental Eye Research 64: 587-95, 1997]

HA AND THE VITREOUS GEL OF THE EYE

The vitreous jelly of the eye is almost completely water (97%) with some collagens and HA. The makeup of healthy vitreous collagen is 92 percent HA and 8 percent chondroitin sulfate. [Biochemistry International 25: 397-407, 1991]

With advancing age the vitreous jelly of the eye begins to lose its consistency, the HA releases water and clumps of HA as well as watery patches appear much like a bowl of Jello looks after it has been stored in the refrigerator for some time. [Albrecht Von Graefes Klin Exp Ophthalmology 196: 187-97, 1975]

This HA breakdown can result in what are called floaters, clumps of protein in the vitreous body that interfere with light traveling through the eye. Floaters appear as cobwebs or insects floating in or in front of the eye.

What causes the breakdown of HA? Because of the transparency of the human eye to light, the vitreous jelly is prone to breakdown by solar ultraviolet rays. Iron, copper, excessive riboflavin or viral attack are other factors that break down HA in the eye. [Current Eye Research 13: 505-12, 1994] When vitreous jelly obtained from animals is exposed to light from a fluorescent lamp along with the administration of riboflavin, the jelly liquefies. Free, unbound copper or iron also induces this destructive process. The addition of vitamin C along with these metals further increases the liquefaction. [Nippon Ganka Gakkai Zasshi 99: 1342-60, 1995]

With advancing years, the vitreous jelly can also shrink and detach from its contact with the retina (called a posterior vitreous detachment), an event that is often accompanied by showers of floaters and what appear to be sparks of light in the field of vision. The injection of the enzyme that degrades HA, hyaluronidase, into the vitreous of animal eyes has been shown to induce a posterior vitreous detachment. [Retina 18: 16-22, 1998] Antioxidant enzymes like superoxide dismutase or catalase, which are produced naturally within the body, and iron chelators may be helpful in preventing or reversing some of the aging changes observed in the vitreous. [Intl Journal Biological Macromol 22: 17-22, 1998] There is more HA in the vitreous of normal eyes

compared to ones where the vitreous has detached. [Graefes Arch Clin Exp Ophthalmology 223: 92-95, 1985]

In a laboratory test, iron chelators inhibited the breakdown of HA obtained from the vitreous gel. Diabetics experience accelerated breakdown of the vitreous due to HA decomposition. [Internatl Journal Biological Macromolecules 22: 17-22, 1998] Diabetics are prone to develop breakdown of the vitreous jelly of the eye due to the degradation of HA. Iron chelators prevent this from occurring. [Internatl Journal Biological Macromolecules 22: 17-22, 1998]

As the vitreous gel degrades and liquefies it becomes watery and thus no longer pushes up against the retina to keep it in place. Retinal detachments are also more likely to occur, particularly among people who are highly nearsighted or diabetics. The breakdown of HA in the vitreous in diabetic retinopathy and retinal detachment have been exclusively associated with the breakdown of HA. [Albrecht Von Graefes Klin Exp Ophthalmology 196: 187-97, 1975]

HA has been found to be a safe vitreous substitute. [Ophthalmic Research 29: 409-20, 1997]

To protect against the age-related breakdown of the vitreous body inside the eyes, protective UV-blocking

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Buffered vitamin C powder usually is accompanied

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HA AND CATARACTS

In the human eye the aqueous fluid bathes the inner eye and delivers vitamin C, glutathione and other antioxidants that help reduce inflammation and retain the clarity of the focusing lens of the eye. However, if vitamin C levels in the lens drop significantly, this permits riboflavin to become oxidized by solar ultraviolet radiation which could result in discoloration of the lens, loss of transparency and a cataract. [Photochemistry Photobiology 72: 815-20, 2000]

High amounts of hyaluronic acid (HA) are found in the vitreous jelly of the eye. Unfiltered sunlight, excessive riboflavin, infections and inflammation may degrade HA in the human eye.



HA AND THE RETINA

The loss of HA production at the back of the eye with advancing age may play a role in the onset of retinal disorders. [Archives Ophthalmology 111: 963-67, 1993] Researchers have discovered that the retina and its blood supply layer (choroid) of the human eye exhibits no HA after the fifth decade of life.

HA is a component of the material between the millions of light-receptor cells in the human retina. [Journal Cell Science 114: 199-205, 2001] Collagen helps to support the light receptor cells (called rod and cones) and its primary component is HA. HA is damaged when retinal detachments occur. [Hyaluronon organization of the interphotoreceptor matrix of the retina, J.G. Hollyfield, www.glycoforum.com]

Among patients with age-related retinal (macular) degeneration, the sclera or white of the eyes becomes

HOW TO LIVE 100 YEARS WITHOUT GROWING OLD

To protect against the age-related breakdown of the vitreous body inside the eyes, protective UV-blocking sun lenses should be worn during daylight hours spent outdoors. Excessive riboflavin (more than 10 milligrams) should be avoided in food supplements. High-dose vitamin C is not harmful unless there is iron overload in the vitreous body. Buffered vitamin C powder usually is accompanied

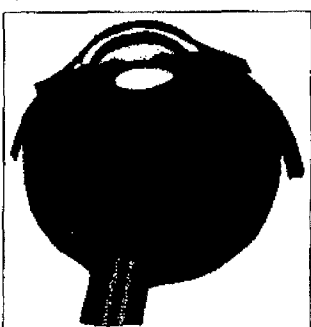
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