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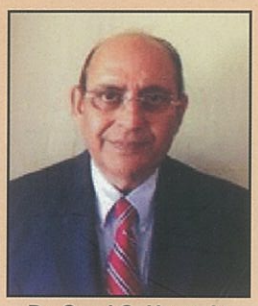

Dr. Syed S. Hasnain
a Pakistani ophthalmologist
who researched and changed
150 years old paradigm of
cupped disc to sinking of optic disc

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Feature


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A Simple Method to Diagnose Glaucoma

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Ms. Sikandra

INTRODUCTION:

A simple method to diagnose glaucoma is being presented which is based on the hypothesis that the optic disc is sinking, not cupping, in chronic glaucoma.[1,2,3] In order to diagnose glaucoma based on the sinking optic disc, we must replace currently used school of thought: cupping and optic disc neuropathy, with the following new paradigms.

Paradigm 1.

The optic disc is sinking in the scleral canal.

Paradigm 2.

Due to sinking of the disc, the nerve fibers are being stretched and ultimately severed against the scleral edge, an optic disc axotomy.

The term "cupping" which implies gradual enlargement of the physiological cup in glaucoma is misnomer for two reasons. **First**, the physiological cup is not truly enlarging but disintegrating, in glaucoma. **Second,** we are already using the term cupping describing various sizes of physiological cups, therefore, the use of term pathological cupping causes unnecessary confusion in glaucoma diagnosis.

What is a physiological cup of the optic disc?

The physiological cup of the optic disc is of various sizes that are produced by varying degrees of atrophy of Bergmeister papilla [4], a tuft of hyaloid vessel in fetal life. If we review the histology of the normal optic disc, the remnant of the papilla base is identified as central connective tissue meniscus lying superficially on the surface of the nerve fibers layer. The meniscus forms the base of the physiological cup, therefore the larger the meniscus, the bigger the size of the cup. Consequently, a larger cup would be covering more area of the nerve fibers and thus smaller exposed area or rim of the disc.

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It has been mentioned that the axons are concentrated in the rim area only, and the cup itself is devoid of axons. However, the histology of a normal optic disc reveals that underneath the meniscus, the entire lamina is packed with nerve fibers and there is hardly any empty space [5]. In fact, the physiological cup is not an integral part of the optic disc and has no clinical significance. Many optic discs have minimal cup or none at all. Since the physiological cups are composed of fibrous tissue, it is unlikely they would become enlarged due to raised IOP because of lack of elasticity.

This presentation will demonstrate that the changes occurring in the glaucomatous disc are mainly due to severing of the prelaminar nerve fibers and blood vessels as a result of sinking disc- a mechanical problem. These pathological events are supported by morphological and histological findings of the glaucomatous discs.

What happens to the optic disc after severance of nerve fibers?

Severing of the nerve fibers results in excavation or empty spaces in the disc, whereas severing of the blood vessels results in hemorrhages at the disc margin, peripapillary atrophy and characteristic pallor devoid of inflammation. Severance of the nerve fibers results in thinning of the RNFL as revealed by optical coherence tomography (OCT). Severing of the nerve fibers and of blood vessels is a unique feature of glaucoma as no other optic disc disease exhibits such a phenomenon.

In addition to the border tissue, the optic disc is anchored in the scleral canal by 360 degrees of the nerve fibers, similarly to the roots anchoring a tree. As the optic disc starts sinking due to atrophy and weakness of the border tissue, the prelaminar nerve fibers become stretched and ultimately severed at the scleral edge. Due to depletion of the nerve fibers, the anchorage of the optic disc is weakened and disc sinks further resulting in severing of additional nerve fibers. The cascade of sinking and severing of the nerve fibers become self-propagated and will continue until all the nerve fibers are severed. This phenomenon may explain as to why

glaucoma cannot be halted despite lowering of the IOP maximally.

Evaluation of the optic disc for glaucoma.

While evaluating the optic disc for glaucoma we have to keep two things in mind: the glaucomatous disc is ***sinking*** and as a result the nerve fibers and vasculature are being ***severed***. If we observe the morphological features of the glaucomatous disc in the context of severing of the nerve fibers, then we would not only determine the glaucoma in its earliest stage, but every stage of the glaucomatous disc with our naked eye; all we may need is an ophthalmoscope or preferably a digital fundus camera.

How do we determine if the optic disc is sinking?

By observing the course of blood vessels as they cross at the junction of the retina and the optic disc: if the course of blood vessels from the retina on to the surface of the disc is straight and the optic disc appears flush with the retina then, of course, the disc is not sinking. We should observe the course of the blood vessels at the disc margin, not to confuse with the normal bending of the blood vessels occurring at the margin of the physiological cup. As the optic disc starts sinking, the blood vessels will also start sloping in pursuit of the sinking disc. The aforementioned simple observation with our naked eye will clearly tell us if the disc is sinking or not.

This article will present the pictures of glaucomatous discs from their earliest to the late stage of the six glaucoma subjects and we would evaluate them in the context of severing of the nerve fibers and its vasculature as a result of the sinking disc.

Stages of the glaucomatous discs:

Since the changes occurring in the glaucomatous discs are gradual and continuous, it is difficult to divide them into definitive stages. However, arbitrarily glaucomatous changes may be divided into three stages.

Early Stage:

Due to the inherent temporal tilt of the disc, the temporal part will reveal glaucomatous changes first. Temporal area will appear pale due to severance of the smaller blood vessels, whereas the temporal scleral edge/border area will appear prominent and visible due to severance and thus thinning of RNFL. Fig 1-6. Splinter hemorrhages may also appear due to severing of the blood vessels at the disc margin. In the early stage there is usually no change in the contour of the physiological cup. There may be generalized peripheral field constriction but usually no arcuate field defects at this stage.

Intermediate stage:

Due to severing of the nerve fibers the excavation or empty spaces are produced in the optic disc. In cases of optic discs with minimal physiological cups the sinking of the disc appears more obvious. Fig 4 Notching in the superior and inferior pole of the physiological cup will start appearing due to severance and depletion of the arcuate fibers. Since the

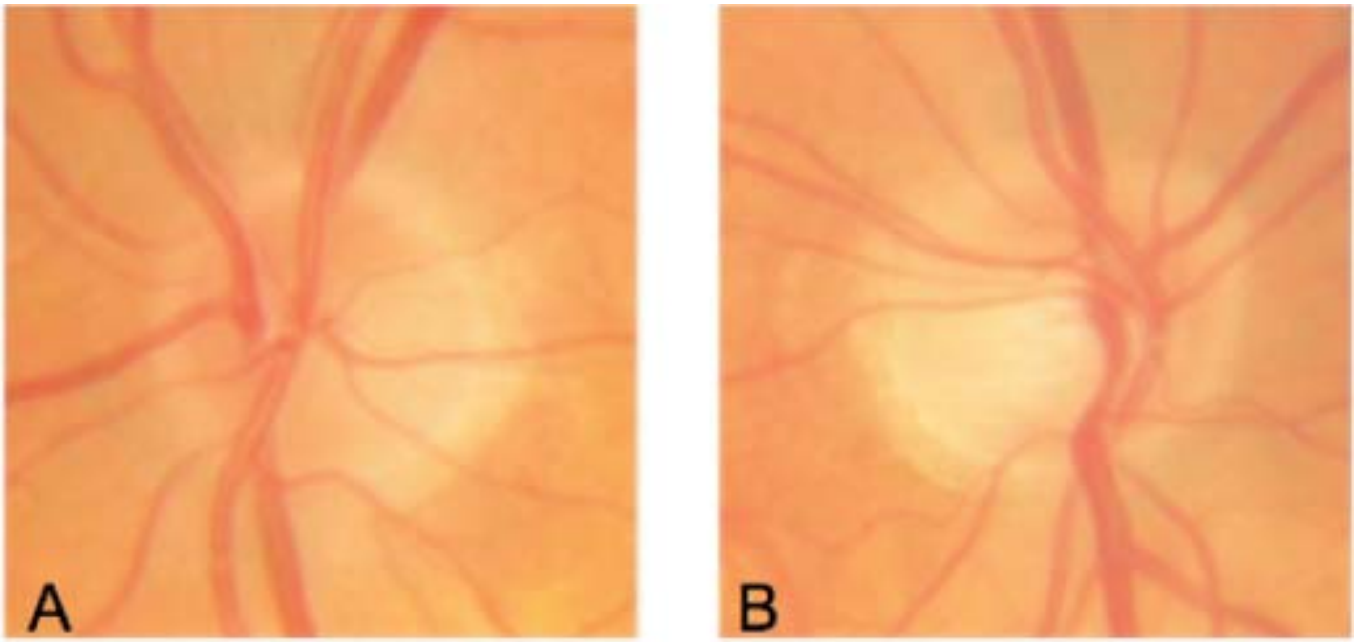

Figure 1 same subject: A. Early glaucoma left eye: Temporal pallor and increased visibility of the temporal scleral edge/rim area. B. Intermediate glaucoma right eye: Inferotemporal area appears pale, sunken and sloping of .blood vessels. Increased visibility of the scleral edge due to thinning of RNFL.Arcuate field defects present.

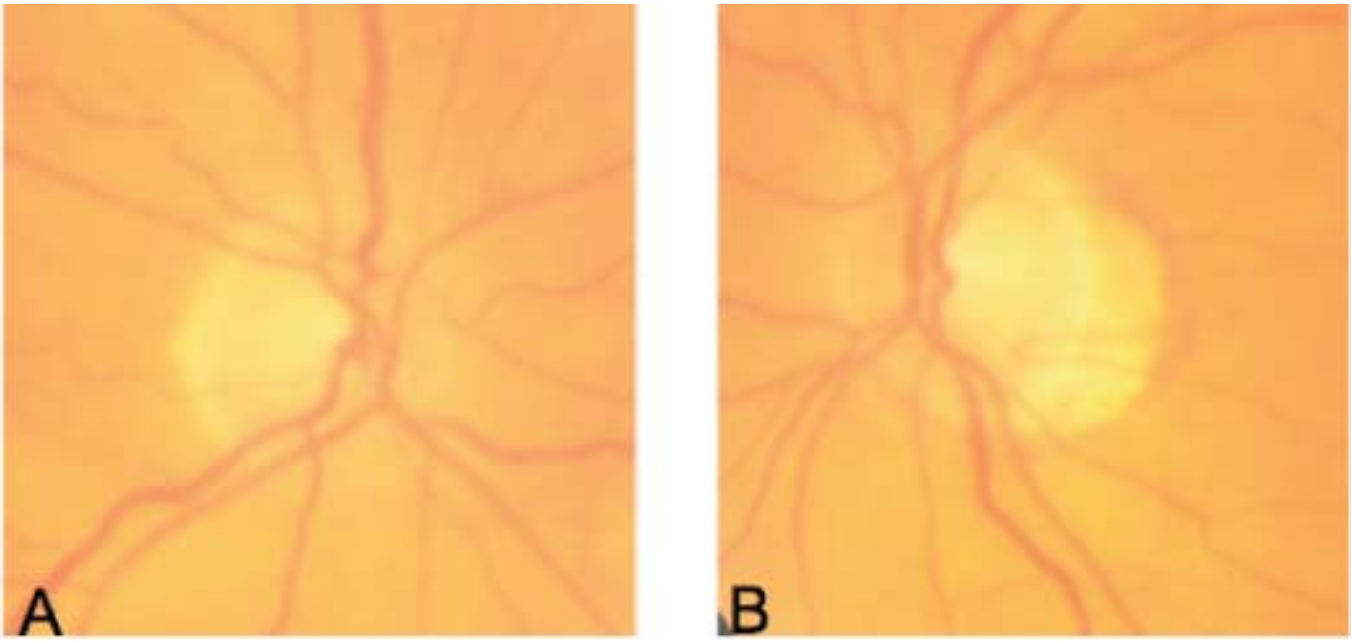

Figure 2 same subject: A. Early glaucoma right eye: Temporal pallor, increased visibility of the temporal scleral edge due to thinning of RNFL. Physiological cup still intact. B. Intermediate glaucoma left eye: Temporal area more sunken, increased visibility of rim and more sloping of the blood vessels. Physiological cup being obliterated due to excavation created by severance of the RNFL.

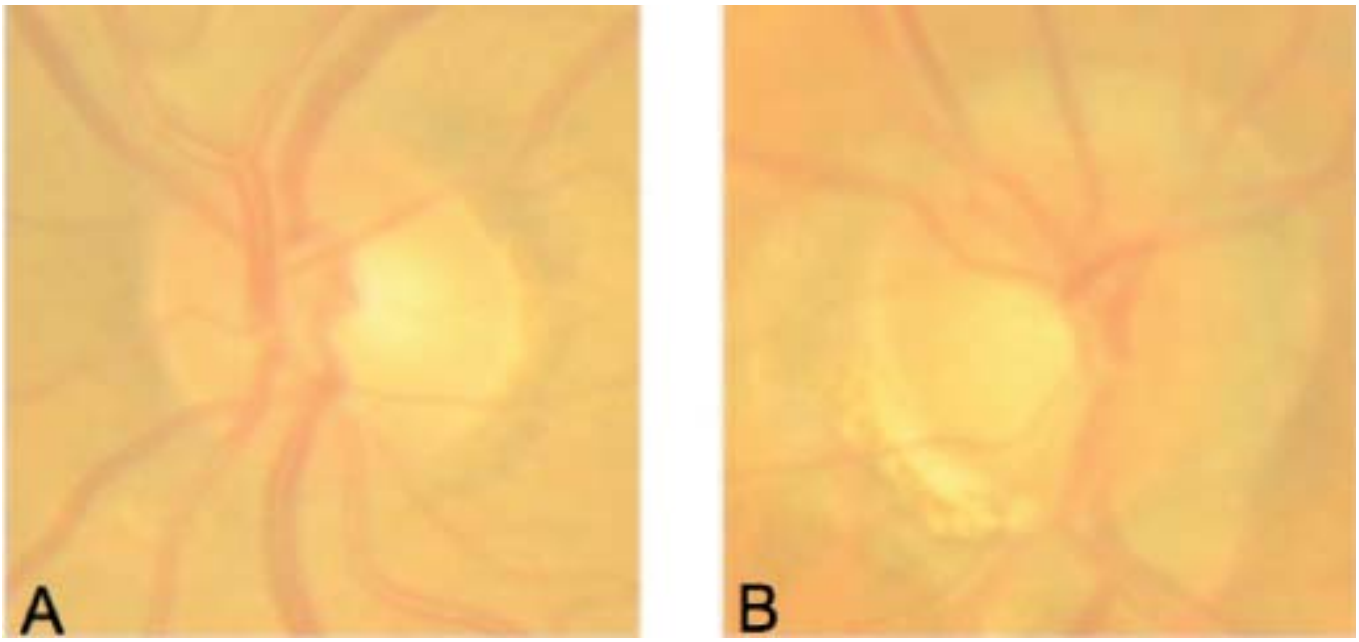

Figure 3 same subject: A. Early glaucoma left eye: Temporal pallor, increased visibility of the scleral edge. B. Intermediate glaucoma right eye: Inferotemporal area pale, sunken and sloping of temporal vessels. Scleral edge area more visible due to thinning of RNFL.Arcuate field defects present.

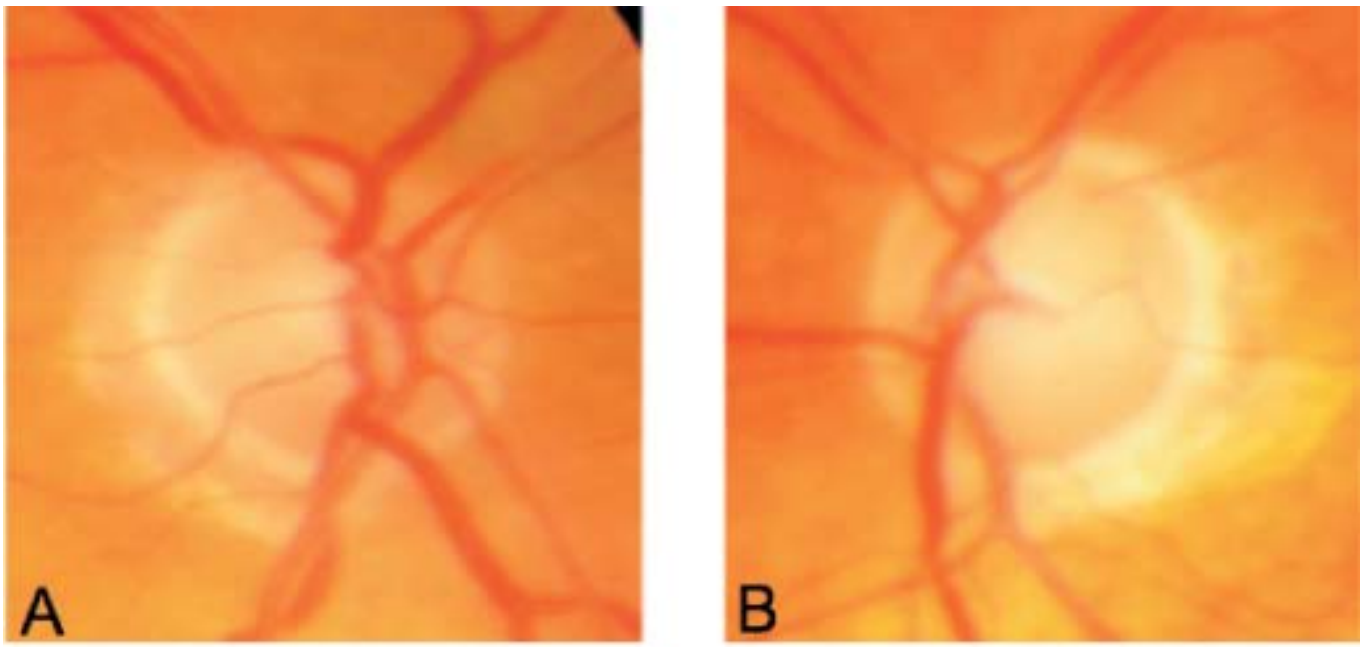

Figure 4 same subject: A. Early glaucoma right eye: Temporal pallor, increased visibility of the temporal scleral edge and sloping of the blood vessels. B. Late glaucoma left eye: Temporal area more pale, sunken and marked visibility of the scleral opening due to thinning of RNFL. Nasal shifting of blood vessels due to severance of the temporal nerve fibers.

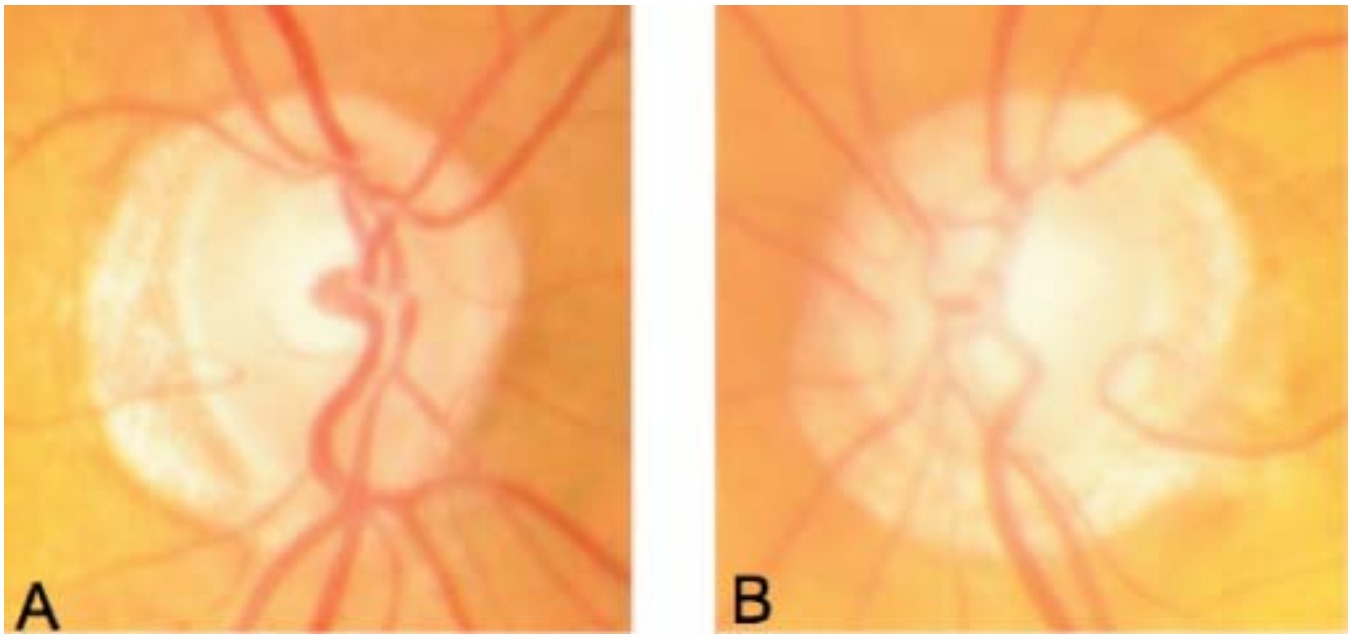

Figure 5 same subject: A. Early glaucoma right eye: Temporal pallor and increased visibility of the temporal scleral edge. Physiological cup still intact. B. Late glaucoma left eye: Marked pallor, excavation and kinking of the vessels at the entire rim. Entire scleral opening is visible due to extreme thinning of the RNFL.

Figure 6 same subject: A. Early glaucoma right eye: Temporal pallor, increased visibility of the temporal scleral edge and sloping of the temporal vessels. Physiological cup still intact. B. Late glaucoma left eye: Marked pallor, excavation and kinking of the blood vessels at the scleral edge. Entire scleral opening is visible due to severance and thinning of the RNFL. Pallor, excavation and kinking of the vessels at the entire rim. Entire scleral opening is visible due to extreme thinning of the RNFL.

physiological cup is now obliterated, it may be called an intermediate stage.

At this stage the visual field defects would start appearing in the paracentral area due to severance and depletion of arcuate fibers. The sloping of the blood vessels will turn into kinking due to progressive depletion of nerve fibers. The central retinal vessels will begin to shift nasally due to loss of anchorage resulting from the severance of temporal nerve fibers.

Analogy: if the roots of a tree are severed from one side, the tree will shift to the opposite side.

Late to End-stage:

In the late stages of glaucoma, the more of the disc area becomes pale and excavated. Due to extreme thinning of the RNFL the entire scleral opening will become visible. Fig 4-6 The area around the disc margin would appear bald due to severance and disappearance of the smaller blood vessels whereas the larger blood vessels would remain hanging on the scleral edge,Fig 4-6.

In ***summary***, the histology of the end-stage glaucomatous disc resembles a totally empty bean-pot which can only be explained if severance, not atrophy of the nerve fibers is occurring. The glaucomatous discs illustrated in this presentation are of six subjects in which one eye has early glaucoma and the contralateral eye in an intermediate or late stage. All these glaucomatous discs reveal the same pattern from the very early to the late glaucoma stage, resulting from the severing of the nerve fibers and vasculature. I believe my colleagues would find my presentation appealing and may agree: if there is no sinking of the disc then there is no glaucoma, irrespective of cupping

References:

1. Hasnain SS. Optic Disc may be Sinking in Chronic glaucoma. Ophthalmology Update. Oct-Dec. 2010; 8 (4); 22-28
2. Hasnain SS. Scleral edge, not optic disc or retina is the primary site of injury in chronic glaucoma. Medical Hypothesis 2006; 67(6) ;1320-1325
3. Hasnain SS, Hasnain AB. Is glaucoma a Neurodegenerative Disease? Could it be a mechanical problem and not a neurodegenerative disease? Ophthalmology Update July-Sept, 2012 10(3); 299-301
4. Wolff E. Anatomy of the Eye and Orbit. Revised by Last R.J. 6th ed London H.K. Lewis & CO;1968. p. 438
5. Wolff E. Anatomy of the Eye and Orbit. Revised by Last R.J. 6th ed. London: H.K. Lewis & Co;1968. Fig. 294, p. 326