PostScript

LETTERS

Mitochondrial DNA abnormalities in NAION

We reported that a group of 19 patients with non-arteritic ischaemic optic neuropathy (NAION) had an increased number of mitochondrial (mt) DNA nucleotide changes¹ and significantly increased relative mtDNA content compared to age and sex matched controls.² We were pleased that Carelli and Sadun thought that our most recent manuscript in *BJO* warranted an editorial response.³ In this letter, we clarify data about mtDNA nucleotide changes and relative mtDNA content in NAION.

Referring to our first report, they stated that "... most of the polymorphisms found in NAION patients are ancient, well known mtDNA variants defining specific haplogroups (mtDNA maternal lineages) of European populations." In fact, we made two observations in that report.¹ The first was that both synonymous and non-synonymous nucleotide changes from the Cambridge Reference Sequence⁴ were more common in NAION patients than in ethnic controls. Second, the NAION group also had 11 novel mtDNA changes and one other nucleotide change that was reported previously in a single mitochondrial myopathy, encephalopathy, lactic acidosis and stroke (MELAS) patient. These unusual changes in 10 patients of the NAION group were clearly not ancient polymorphisms.

Referring to our recent report of increased relative mtDNA content in NAION patients,² Carelli and Sadun noted that metabolic stresses known to be associated with NAION, such as diabetes and hypertension, could increase relative mtDNA content. We agreed that a control group matched for major atherosclerotic risk factors would address the question of whether these metabolic stresses are responsible for increased relative mtDNA content in NAION patients. Therefore, we have simultaneously assessed relative mtDNA content as described previously² in the same 19 NAION patients and in 85 controls selected from a previous cardiovascular study⁵ who were matched for ethnic background, age, sex, diabetes, hypertension, smoking history and coronary artery disease.

Table 1 shows that age, sex and prevalence of diabetes, hypertension, smoking and coronary artery disease were well matched

between NAION patients and controls. Nevertheless, relative mtDNA content in NAION patients was again more than twice that in controls, indicating that these metabolic stresses were not responsible for the dramatic increase in relative mtDNA content. This data is pertinent to the points raised by Carelli and Sadun for at least two other reasons. First, new mtDNA content values in NAION patients were strongly correlated with values reported previously² (Pearson correlation 0.977, $p < 0.001$), proving the reproducibility of relative mtDNA content measurement. Second, increased relative mtDNA content was again predictive of worse vision in both eyes (Pearson's correlation -0.383 , $p = 0.018$).

These data answer the concern that known metabolic stresses might induce changes in relative mtDNA content in NAION patients. Compared to controls, this small group of NAION patients in Saudi Arabia has more total mtDNA sequence changes, more novel mtDNA changes and elevated relative mtDNA content. These observations taken together with the association between mtDNA content and visual acuity suggest that mitochondrial abnormalities may constitute a risk for NAION. Similar studies should be performed in NAION populations from other ethnic backgrounds.

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Controversies in the history of glaucoma: is it all a load of old Greek?

Contemporary medical terminology frequently stems from ancient Greek origins. However, there is some controversy relating to the true derivation of the word "glaucoma". The disorder, now defined as glaucoma, was first documented by the Ancient Greeks in 400 BC.¹ "Glaucoma" was first mentioned in Hippocratic writings as a blinding disease occurring most commonly in the elderly.² The description stated "that once the pupil has the colour of the sea – eyesight is destroyed and you will often find that the other eye is also blind". It is thought that this condition probably included various sight-threatening conditions including cataract and keratitis in addition to glaucoma. Opacification of the cornea or the lens resulting in apparent discolouration of the eye would have made the condition recognisable without ophthalmoscopic or slit-lamp technology. It is highly likely that the only type of glaucoma recognised in ancient times was symptomatic acute glaucoma and that the associated corneal oedema resulted in the disorder being grouped together with other conditions such as cataracts or those affecting the cornea.

It has been proposed that the word glaucoma originates from the ancient Greek word γλαῦξ – γλαῦκος (glaukos) a noun and adjective originating from the verb 'γλαῦσσω' (glauosso), meaning "to glow" or "to shine". The adjective describes someone who or something that glows or shines, this perhaps relating to the "hot" eye with acute glaucoma. However, with respect to colour, the ancient word also represents "blue-white" or "blue-green" and in the case of eyes it is thought to represent eyes having the light-blue or sea-green hue attributable to corneal oedema/opacification or cataract. In the English literature the derivation of the word glaucoma is always stated as relating to this bluish or greenish colour. However, the Greek word "glaukos" also means owl, which is thought to be so-named because of the bird's fierce, big and glowing eyes. The ancient Greek goddess Athena and the city named after her (Athens) was named γλαυκῶματι in Greek and this translates to "glaucomati" meaning "having the eyes of an owl", thought to reflect the fact that she was so wise (like an owl). This ornithological (from greek ornitha meaning bird or chicken) issue increases the controversy relating to the exact origin of the word 'glaukos' and thus 'glaucoma'. There is thus a chicken (or perhaps owl!) and egg problem, since it is unclear as to whether the word glaukos was first used as a verb (to glow/shine), adjective (blue-green) or

Table 1 Age, sex and prevalence of diabetes, hypertension, smoking and coronary artery disease between NAION patients and controls

	NAION (n = 19)	Controls (n = 85)	p Value
Age in years (SD)	58.8 (8.5)	58.2 (7.0)	0.087
Male:female	14:5	62:23	0.895
Diabetes mellitus (yes:no)	13:6	54:31	0.381
Hypertension (yes:no)	10:9	37:48	0.645
Smoking (yes:no)	7:12	37:48	0.200
Coronary artery disease (yes:no)	2:17	16:69	0.063
Relative mtDNA content (SD)	2.95 (1.13)	1.33 (0.34)	<0.001

NAION, non-arteritic ischaemic optic neuropathy.