

# Miner's Nystagmus

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How often have you asked one of your fellow collectors, "How did they ever see to work with that thing?" The amount of light provided by that early Davy, Anton oil or miner's candle was quite minimal and eye problems did occur. A form of nystagmus (ni stag'mūs) was seen exclusively in coal mines.

I first became acquainted with Miner's Nystagmus when I read Jim Steinberg's article in issue No.1 of the Mining Artifact Collector.<sup>9</sup> In my thirty years as a physician, I had never learned of Miner's Nystagmus. In Eureka! # 6, the article "Daylight" by Thorpe and Johnson on The Daylight Carbide makes reference to Miner's Nystagmus in old advertising. (Fig. 1).<sup>10</sup>

Nystagmus is a condition of uncontrolled flickering of the eyes. This flickering can be side to side (horizontal nystagmus), up and down (vertical nystagmus) or a combination (rotatory nystagmus). Most cases of Miner's Nystagmus were of the rotatory variety. Oscillations occurred at 100-350 per minute!! Miner's Nystagmus occurred among coal miners and never among other metalliferous miners.

The history of Miner's Nystagmus is interesting but complex. As early as 1861 eye physicians in Belgium began to see a peculiar type of nystagmus, but they did not clearly relate this to mining. Miner's Nystagmus was reported as a "new disease" in 1875 at a London eye convention.

Most of my research centers on the original articles from the British literature 1875-1915. I was fortunate to obtain a copy of Bulletin 93 (1916) published by the U.S. Dept. of Interior, Bureau of Mines, describing the problems of Miner's Nystagmus in the United States and Europe.

Two theories advanced as to the cause of this disease and controversy raged back and forth in medical literature. Both theories will be presented here. One theory blamed muscle fatigue due to "holing." The other blamed the inadequate light of safety lamps. Dr. Simeon Snell writing in 1875 in the British Medical Journal felt that the cause of Nystagmus was directly related to a type of coal mining called 'holing.'<sup>8</sup> Miners were paid only for coal tonnage that did not pass through a certain size screen so that the larger pieces of coal, the more profitable. Snell's description of this mining method:

...the man engaged in winning the coal and the manner in which his work is accomplished possess the most interest to us. His business is to detach the coal from the coal seam generally by holing under the seam. To do this he has to work in a peculiar position. He sits down with his legs crooked up, lying almost on his side and strikes with his pick at the bottom of the coal, his object being to undermine or undercut the seam. He will clear away the coal thus to a height of 18 inches or two feet and then as he gets deeper in, he gets his body under the coal, lying on one or

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The printed report of the Committee which investigated the cause of Nystagmus shows the advantages of using Acetylene Lamps to overcome this complaint.

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Fig. 1, from *Eureka*, 6:26, April, 1993



the other of his sides. The distance he may undercut the coal varies considerably.

This position, lying on one side of the body, while swinging the pick in a horizontal fashion caused the miner to have to look upward or obliquely and to tilt his head in an upward manner (Fig. 2).<sup>2</sup>

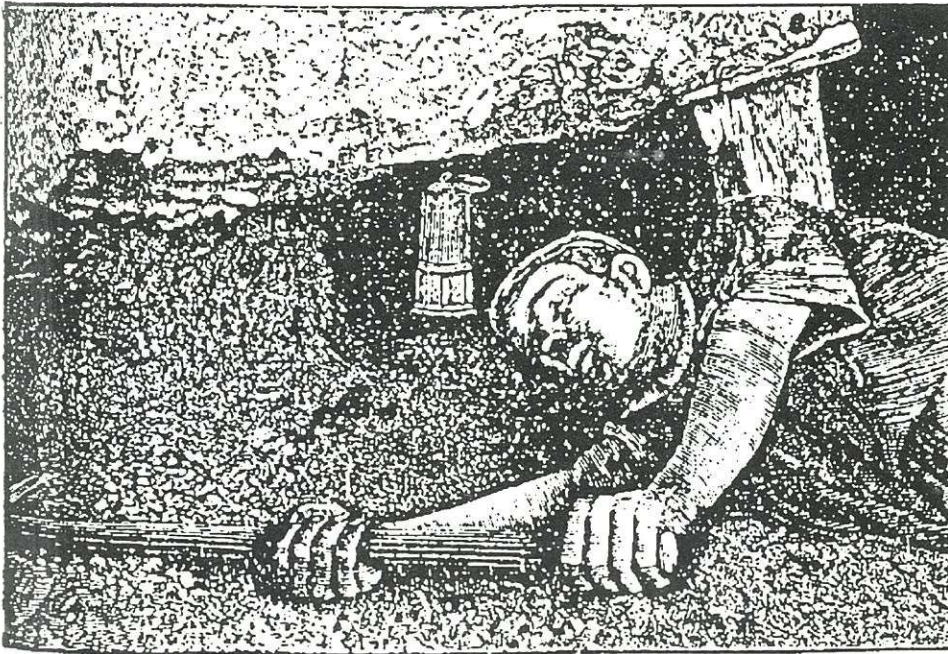


Fig. 2, from *BMJ*, Oct. 15, 1892, pg. 837

His light had to be placed some distance from the coal face either near his head or feet. Snell theorized that this prolonged fixation of the eyes led to a fatigue of the muscles of the eyes and resulted in the involuntary twitching.

Snell makes arguments showing that miners doing other jobs in the mines seldom developed nystagmus unless they also did holing. In Snell's district, the use of safety lights was the usual form of lighting so he solicited other physicians to contribute patients to his study who had developed nystagmus

using "naked" light such as torches or candles. His conclusion was that it was the fatigue of the eye muscles from "holing" that caused the miner to develop nystagmus.

The other prominent theory advanced by Dr. T. Lister Llewellyn in 1912 was that safety lamps were the culprit in causing Miner's Nystagmus. "Owing

to the deficient light in a coal mine, the images formed in the eyes are indefinite and inexact; this leads to indecision on the part of the controlling mechanisms in the brain, with the result that irregular inco-ordinate (sic) movements of the eyeballs ensue."<sup>6</sup>

Llewellyn goes on to present data to show that nystagmus rarely happens in colliery districts where the predominant lighting is candles. He presents data to show that almost 50% of his cases of nystagmus had done no "holing". He further advances his theory

by explaining that the wax candles provide one candle power but that tallow candles commonly used may be equal to two wax candles. The candle was also placed closer to the coal face and since the intensity of the light is inversely proportional to the square of the distance, a much more intense light resulted.

Oil safety lamps rarely gave more than  $\frac{1}{3}$  candlepower and inevitably gave much less light as they became dirty very quickly. The safety lamp had to be placed much further away from the head wall, further decreasing the illumination. As oxygen percentage decreased, the intensity of light from safety lamps decreased rapidly. In coal mining practically all ambient light is absorbed and the advantage of reflected light is lost. These factors led Llewellyn and others to conclude that the inadequate illumination in the coal mine from the use of safety lamps led to Miner's Nystagmus. In fact, it was not until after compulsory use of safety lamps in 1876 that a steady increase in the number of cases of Miner's Nystagmus was noted.

Regardless of the theory (holing vs. light) the symptoms and findings of Miner's Nystagmus were now being recognized. Nystagmus usually did not develop until a miner had worked in the mines for 10-20 years. The disease was very uncommon below the age of 25 and the average age was 39 years. The oscillations were often accompanied with headache, lightheadedness, nausea and vomiting, and general nervousness. Lights were seen to flicker and run into each other. A miner with nystagmus was often unable to read the "CAP" on his safety lamp.<sup>7</sup> Night blindness and photophobia (avoidance of light) were



also common. Twitching of the head and muscle spasms in the neck were ominous signs. Suicide and insanity were also attributed in a rare case.

If the miner was removed from the pit for a considerable length of time, some could return to work (35%), others were able to resume work at the surface (43%), but the remainder (22%) remained idle or left mining entirely. The prognosis depended on age, length of symptoms before failure, how much vision was affected, and presence or absence of twitching of the head.<sup>5</sup>

In 1906, English law included Miner's Nystagmus as an occupational disease under the Workman's Compensation Act. This resulted in a considerable increase in the number of cases reported. Estimates of frequency vary but one source reported 5-25% of all workmen employed underground to be affected.<sup>7</sup> Llewellyn estimates the disease to have cost England over 155,000 pounds for disability, a considerable amount of money in today's dollars (\$8 - 12 billion).

By 1913 most English physicians accepted Llewellyn's theory and called for a Royal Commission to study lighting in British mines. They felt that if the electric light were compulsory, nystagmus would become a historical disease.<sup>1</sup>

In the United States, Miner's Nystagmus failed to attract the level of attention it did in England and Europe; in fact there are few reports on this disease in U.S. literature. One source I was able to find was Bulletin 93 on Miner's Nystagmus which contained a report of an Illinois Commission On Occupation Diseases of January 1911.<sup>4</sup> This Commission reported the low

incidence of nystagmus in this country attributable to two factors. First, the greater use of mechanization, and second, the gross-weight law allowing the size of coal to be unimportant and making it unnecessary to practice "holing" - remember Snell!! The Commission's conclusion was that the disease was rare due to these factors and that the only cure was a cessation of the occupation that caused it. Their conclusion lacked a great deal of scientific thoroughness - they never even mentioned light!!<sup>4</sup>

The conclusions printed in Bulletin 93 published in 1916 included facets of both theories of the causes of Miner's Nystagmus. It was concluded that there was less nystagmus in the U.S. because of increased use of mechanization to undercut the coal rather than the use of the pick for holing. Also, the safety lamp was largely supplanted by open flame oil lamps, carbides, or electric lights.

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I discussed these reports and conclusions with two current medical colleagues (both ophthalmologists). Though they were unfamiliar with Miner's Nystagmus they recognized the condition to be due to lack or absence of light. Though both theories (Snell and Llewellyn) were interesting to review and plausible in their time, retrospectively one must conclude that the cause of Miner's Nystagmus was safety lamps. A subsequent report of the U.S Public Health Service, 1941: Soft Coal Miner's Health and Working Environment fails to mention Miner's Nystagmus.<sup>3</sup> Indeed it had become only a historical disease.

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