SIII-3

The Moving Magnetic Pole

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The theoretical force-distance (f-d) relationship between a magnetic dipole and a magnetically permeable plane has been shown at a previous meeting to be according to the inverse square law at small separations and an inverse fourth power relationship when the separation is larger. However, attempts at experimental verification of such relationships with commercial dental magnets as well as with thin long magnetic rods were most entirely successful. One problem seemed to be the location of the magnetic pole within a magnetic assembly especially with a non-magnetic cladding. Different models with offset distances and scaled force were tried but were inadequate to describe the f-d relationship throughout the range of separation. The problem was partly soluble if it was assumed that the position of the magnetic pole within a magnet was movable when the magnet acted against a magnetically permeable plane-the pole moving as if it were attached to a spring fixed at one end. The best fit to data was obtained with the separation given by $d = k \log(F) + q / 2\sqrt{F-x}$. From plots of the fitted parameters, it was apparent that the greater the pole strength, the deeper the pole appeared to be within the magnet. As the magnet was moved nearer the permeable plane, the pole appeared to move nearer the end of the magnet, but the logarithmic dependancy of this was equivalent to the 'spring' becoming progressively stiffer. The 'moving pole' model, however, did not fit the data for commercial dental magnets (short dipoles), the behavior of which appeared to be very complex.