D2 The Role of the Dynamometer in the Analysis of Manner of Death by Asphyxia: A Case Report and Review of the Literature

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Learning Overview: After attending this presentation, attendees will understand the role of the dynamometer in the study of cases of asphyxia.

Impact on the Forensic Science Community: This presentation will impact the forensic science community by demonstrating the applicability of the dynamometer for studying the entity of the force and for the correct analysis of dynamics in cases of asphyxia.

Asphyxia is the respiratory failure caused by stopping the passage of air in the respiratory tract. It includes ligature strangulation that requires the use of a tool such as a cord applied around the neck. The strangulation includes the application of a force, a vector with a point of application, direction, and intensity. These characteristics can be measured by using the dynamometer, a device consisting of a spring and a graduated scale. In forensic literature, studies concerning the dynamometer are not reported. In this work, the dynamometer was used to reproduce an experimental model useful for studying the manner of death in cases of asphyxia.

In this case, a woman reported her husband for trying to strangle her by using an electric cable. The woman said she had placed her hands between the cable and her neck in an attempt to defend herself. From the statements, it emerged that during the struggle, both fell on the floor. The man confessed what had happened, but declared that he had never intended to kill her and that he had not exercised intense traction on her neck. The investigators collected the testimonies and carried out the analysis of the scene. The cable was seized and examined. The victim was analyzed with an examination of anthropometric measurements. The investigators reproduced an experimental model using a cable similar to the one seized. The cable was configured by reproducing a knot with a rope. The circumference was inserted around the neck of a dummy with characteristics similar to human skin. The free end of the cable was attached to a Crane Scale® digital dynamometer, capable of measuring the force in kilos (kg) on the display. The operators (both male and female) proceeded to: (1) tensile tests of the dynamometer at increasing intensity until maximum individual strength was reached; (2) evaluate the interaction between the cable and the surface of the dummy; (3) vary the application force both in intensity and in direction; (4) pull the cable, placing the knot on the lateral side of the neck (both anteriorly and posteriorly, then laterally to the right and left); and (5) simulate the tight constriction of the loop by interposing the hands of the dummy between the rope and the neck, according to the dynamics reported by the woman.

The cable had a diameter of 8mm and a rope with a knot showing blood stains. The inspection of the victim revealed some ecchymosis only on the left and back side of the neck. The victim had no other injuries except for bruising on her wrists.

The model showed that by pulling the cable, it was possible to restrict the circumference of the loop and compress the neck, easily reaching 5kg of force (minimum 2kg, max 25kg).[1] The cable caused a blunt tangential action on the tissue. The position of the knot on the lateral side of the neck caused a tight constriction mechanism of the loop on the posterior area of the neck, compatible with the victim's injuries. The experimental study showed that, even with the hands below the cable, it was possible to cause an intense traction. Finally, the position of the victim lying on the floor increased the negative effects of tight constriction. The manner was therefore compatible with a strangulation occurring by tightening the cable with the knot on the left neck area. In literature, four variables have been identified that have an interaction with the outcome of a strangulation: position, direction, force intensity, and surface of application.[1-3] In this case, the dynamometer allowed the estimation of the force applied on the neck and the study of the injuries caused on the tissue by analyzing potential measurable combinations in relation to the testimony and to the injuries analyzed. The data were used in court as scientific support to demonstrate the homicidal intent of the perpetrator and the reliability of the victim's statements.

The dynamometer offers the advantage of: creating reproducible models at low cost; studying the effects of forces pre-established by the operator; reproducing different dynamics; and verifying the witnesses.

It would not be applicable in suffocation and strangulation by the hands in which there is not a tool on which to apply a traction and, therefore, to measure the force.

Reference(s):

1. Yamasaki S., Takase I., Takada N., Nishi K. Measurement of force to obstruct the cervical arteries and distribution of tension exerted on a ligature in hanging. *Leg Med (Tokyo)*. 2009 Jul;11(4):175-80.
2. Khokhlov V.D. Pressure on the neck calculated for any point along the ligature. *Forensic Sci Int*. 2001 Dec 1;123(2-3):178-81.
3. Khokhlov V.D. Calculation of tension exerted on a ligature in incomplete hanging. *Forensic Sci Int*. 2001 Dec 1;123(2-3):172-7.

Forensic Sciences, Asphyxia, Dynamometer