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Electrical Stimulation to a 21yr Female Patient with Facial Nerve Axonal Neuropathy After ORIF with Titanium Metal Implant for Mandibular Fracture: A Case Study

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ABSTRACT

The mandible fracture is one of the most common fractured bone. Most of the nasal fractures managed with conservative management but Mandible fracture used to be treated with surgical management because of its complexity of the structural anatomy and function [(1)]

CASE REPORT: A Case of 21-year-old female with mandible fracture underwent open reduction surgical implant using titanium metal in Vels Medical College and Hospital, Manjankaranai. The patient was treated with Electrical stimulation.

RESULTS: The outcomes of SD Curve (sensory nerve) was approximately maintained from Chronaxie – 0.03 ms, Rheobase – 52 mA to Chronaxie – 0.03ms, Rheobase – 60 mA for upper trunk of facial nerve. For middle trunk, maintained from Chronaxie – 0.03 ms, Rheobase – 49mA to Chronaxie – 0.03ms, Rheobase – 49 mA and for lower trunk from Chronaxie – 0.03 ms, Rheobase – 59 mA to Chronaxie – 0.01 ms, Rheobase – 60 mA. The outcomes of SD Curve (motor nerve) were increased from Chronaxie – 0.3 ms, Rheobase – 52 mA to Chronaxie – 0.1 ms, Rheobase – 20 mA for upper trunk of facial nerve. For middle trunk, from Chronaxie – 3 ms, Rheobase – 49mA to Chronaxie – 0.1ms, Rheobase – 19 mA and lower trunk from Chronaxie – 10 ms, Rheobase – 51 mA to Chronaxie – 0.1 ms, Rheobase – 26 mA and FDI improves from 47 to 91.

CONCLUSION: Thus, this study states that the Titanium metal has some electrical properties and electrical stimulation can be given to the metal implanted area. But further studies needed.

Keywords: Open reduction, Electrical Stimulation, SD Curve, Axonal neuropathy.

INTRODUCTION

The mandible fracture is one of the most common fractured bone. Most of the nasal fractures managed with conservative management but Mandible fracture used to be treated with surgical management because of its complexity of the structural anatomy and function [(1)]. The incidence of the mandible fracture is 3 times more common for males compared to females and occurs in the third decades of life [(1),(2)]. The mandible fracture can be classified by favorableness based on the association between the direction of fracture line and the way muscle action. Depend on the fracture location, Patient presents with Trismus, dental

malocculation, swelling and tenderness externally and intra-orally. Damage to Inferior alveolar nerve results in anesthesia to lower lip and chin [(4)].

The Closed reduction surgical management has more disadvantages like ramus shortening, ankylosis and arthritic changes [(6)]. The paucity of literature supporting vivo use of lambda plate necessitated our clinical study to evaluate the efficacy of 2mm titanium lambda plate in open reduction and internal fixation of subcondylar fracture of mandible. Facial weakness and nerve injuries are more common complication in open reduction then closed reduction.

Current evidence discourages the use of Electrical stimulation in the acute stages of Bells's palsy to prevent the unintentional damage to muscle fibres[(29)]. Although Electrical stimulation is widely used as it may cause an increase of residual effects and delay regeneration of facial nerve (Diels 2000) [(28)].

The strength-duration curve is a graphical representation of the relationship between the intensity of an electrical stimulus at the motor point of a muscle and the length of time taken to elicit a minimal contraction in that muscle. Here, strength refers to the stimulus intensity on the vertical axis while duration refers to the pulse duration on the horizontal axis. It is used to determine nerve damage in lower motor neuron lesions [(19)]. The SD Curve is useful in examination of sensory and motor nerves in peripheral neuropathy patients [(21)]. Facial Disability Index was developed in order to evaluate the disability resulting from the injury to the facial nerve [(22)]. The Facial Disability Index produces reliable measurement with construct validity for measuring patients focused disability of individuals with disorders of the facial motor system [(18)].

CASE STUDY

A Case of 21-year-old female with mandible fracture (Figure 1) underwent open reduction surgical implant using titanium metal (Figure 2) in Vels Medical College and Hospital, Manjankaranai. After surgical management patient experienced facial weakness and advised to take NCV to access the motor and sensory electrical conductivity of facial nerve and diagnosed as Facial Nerve Axonal Neuropathy. Patient had weakness of left side of the face, drooping of left eye lid and deviation of mouth to right side, difficulty in eye closing and frowning of left eye and underwent pharmaceutical management for 2 months. The patient was referred to Department of physiotherapy for further management after 2 months of pharmaceutical management and taken SD Curve (Graph 1, 2, 3, 7, 8, 9) and Facial Disability Index as pre test. The electrical stimulation was given for 6 weeks with 5 days per week. At the end of 6th week SD Curve (Graph 4, 5, 6, 10, 11, 12) and Facial Disability Index as post test were taken.

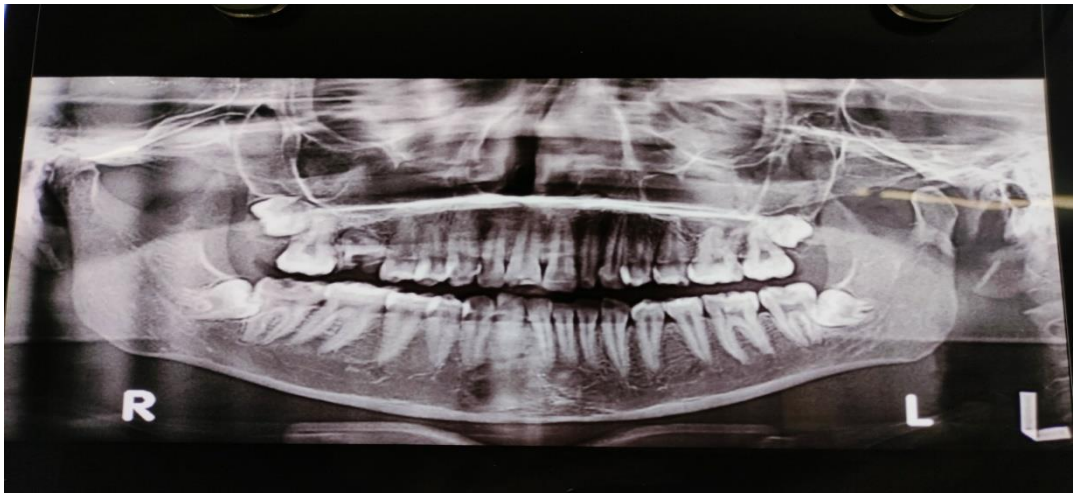


Figure 1

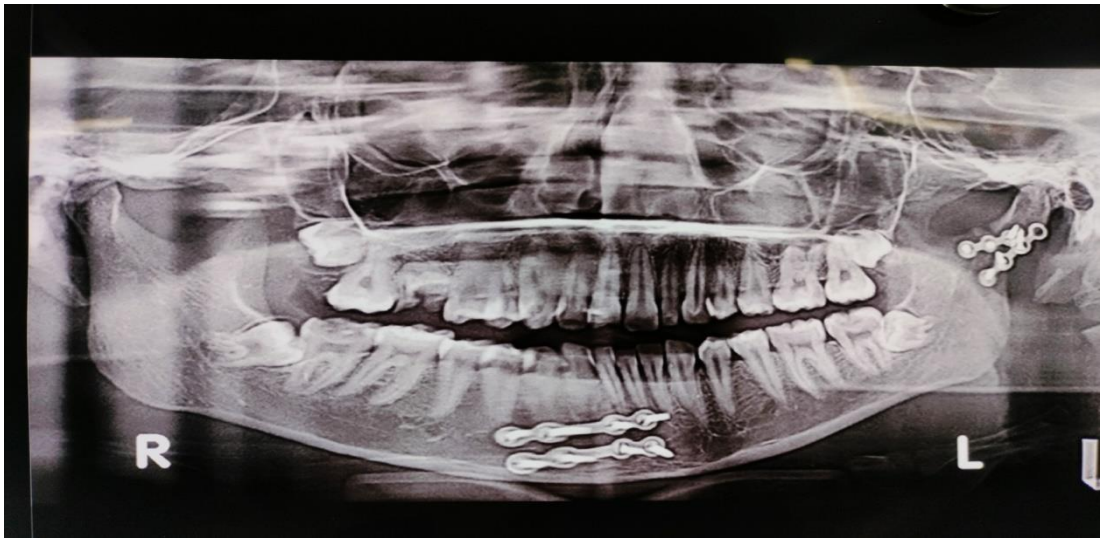


Figure 2

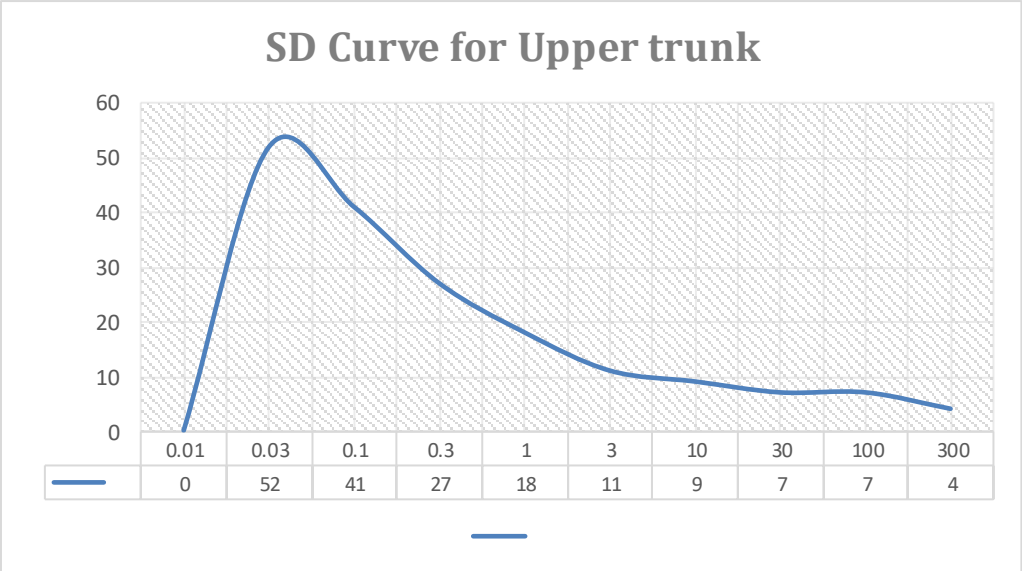
MATERIALS & METHODS

The patient was treated with Electrical stimulation (Galvanic and Faradic Current). The inactive electrode placed over the nape of neck and active electrode placed over motor points of facial muscles. Intensity was raised upto notable visible contraction. Duration was 15 to 30 counts for each facial muscle for Galvanic current. For Faradic current, the active electrodes over the trunks of facial nerve and duration were 12 to 18 counts for each trunk. The duration of each session was 20 min. The pulse duration and frequency was determined using SD Curve. Facial Disability Index and SD Curve were used as outcome measures.

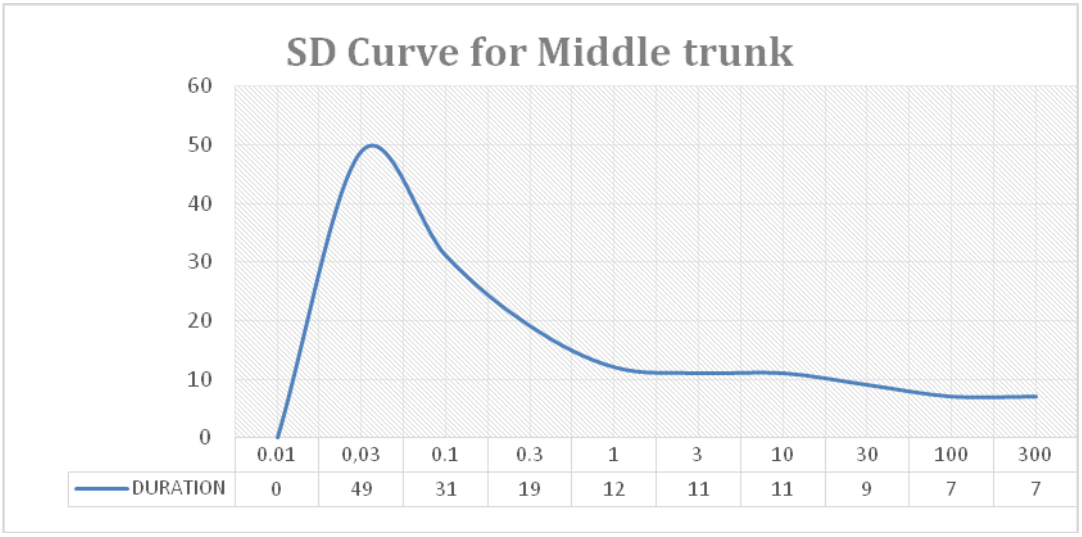
RESULT

The pre and post test of Facial Disability Index are 47 to 91 respectively. The pre test of SD Curves Sensory (Graph 1, Graph 2, Graph 3) and post test of SD curve sensory (Graph 4, Graph 5, Graph 6) and the pre test of SD Curves (motor) (Graph 7, Graph 8, Graph 9) and post test of SD curve (motor) (Graph 10, Graph 11, Graph 12) were given below,

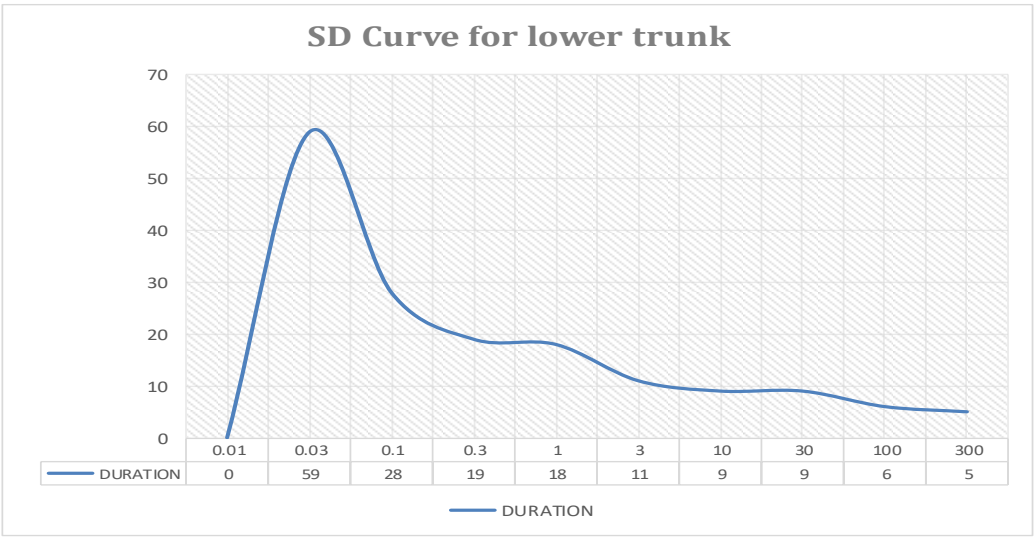
SD CURVE (SENSORY NERVE):



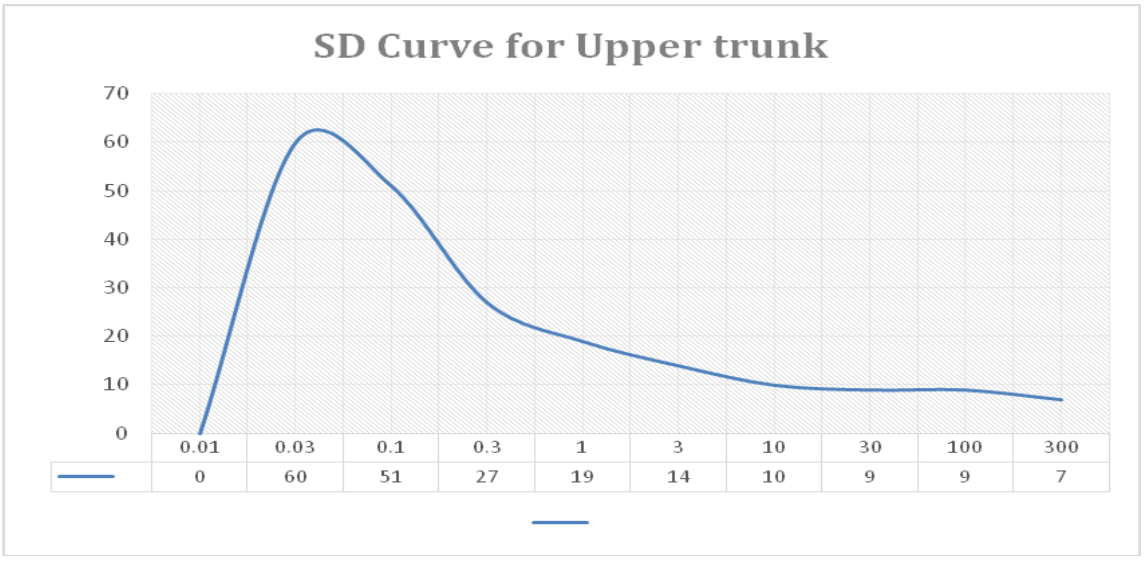
Graph 1



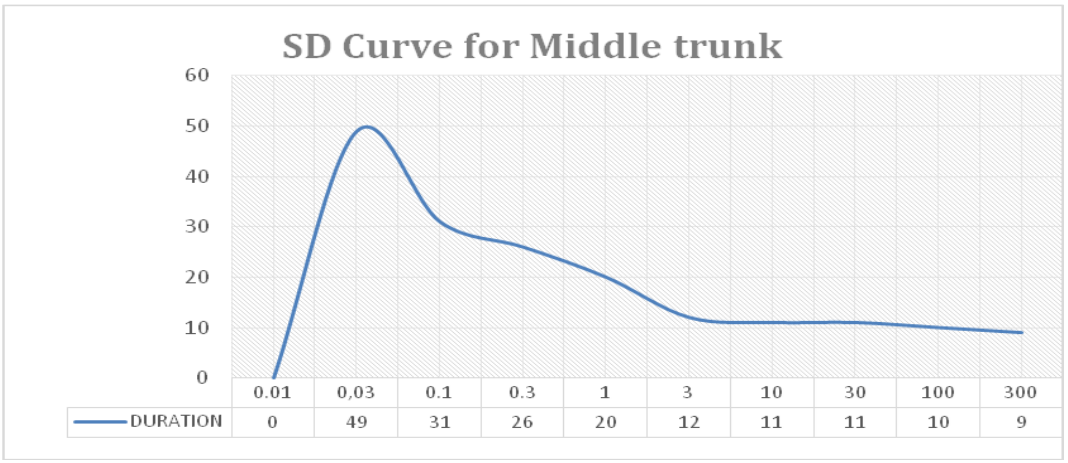
Graph 2



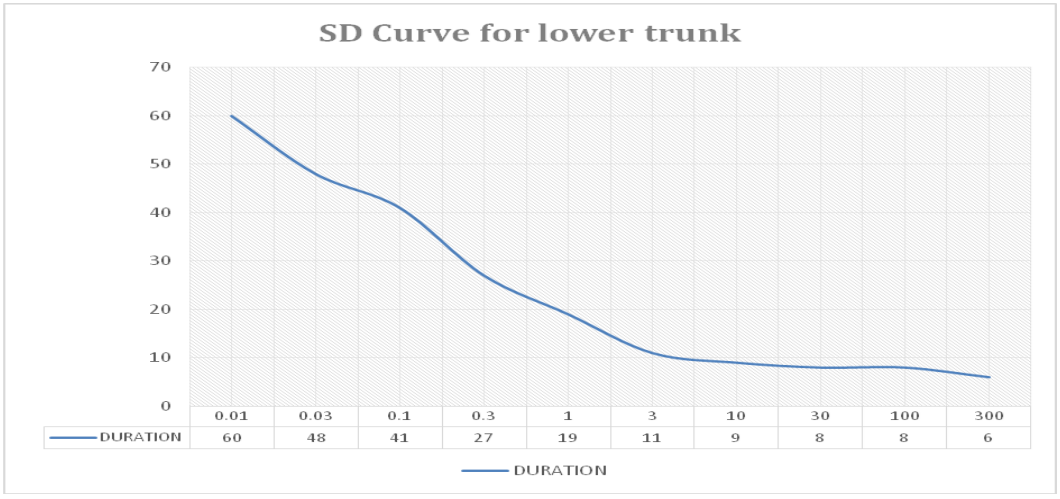
Graph 3



Graph 4

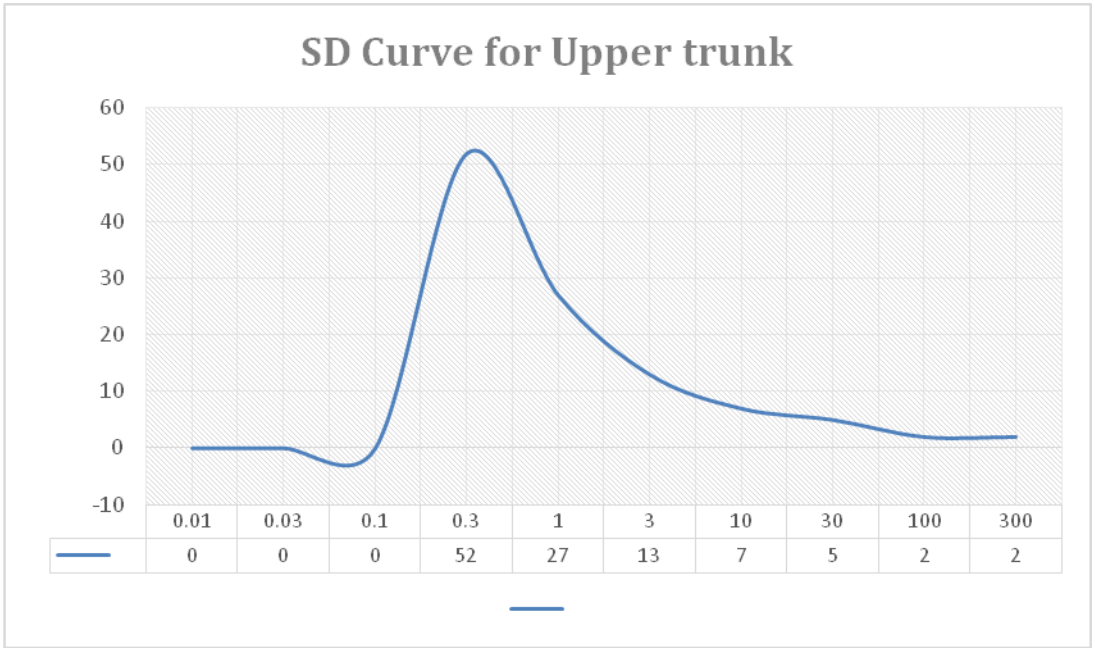


Graph 5

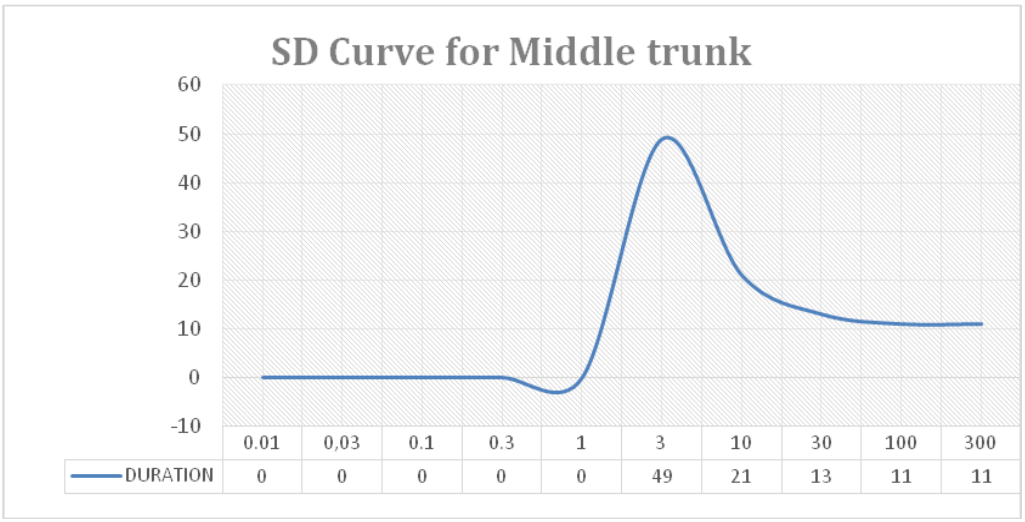


Graph 6

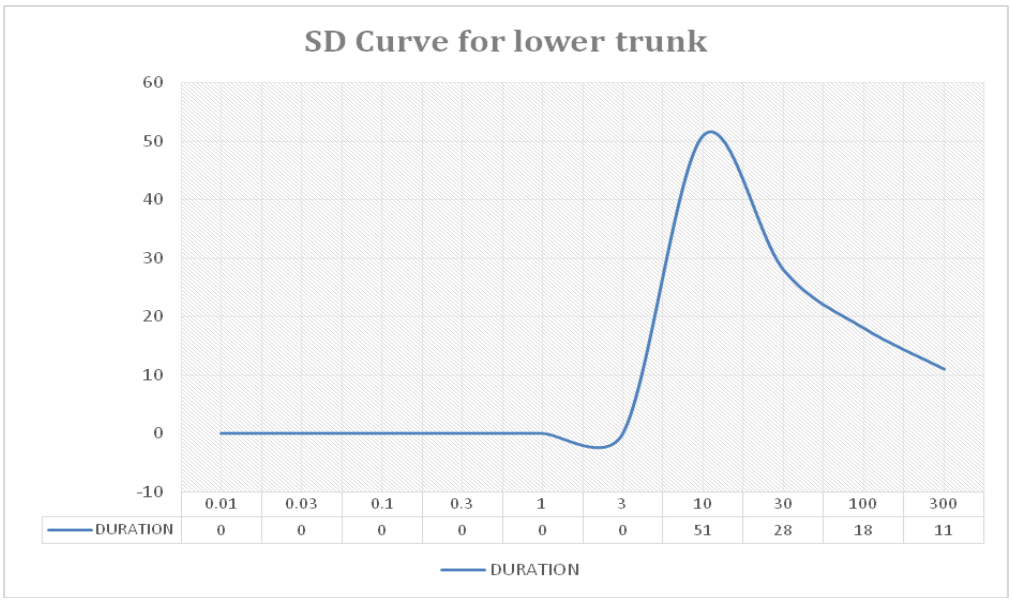
SD CURVE (MOTOR NERVE):



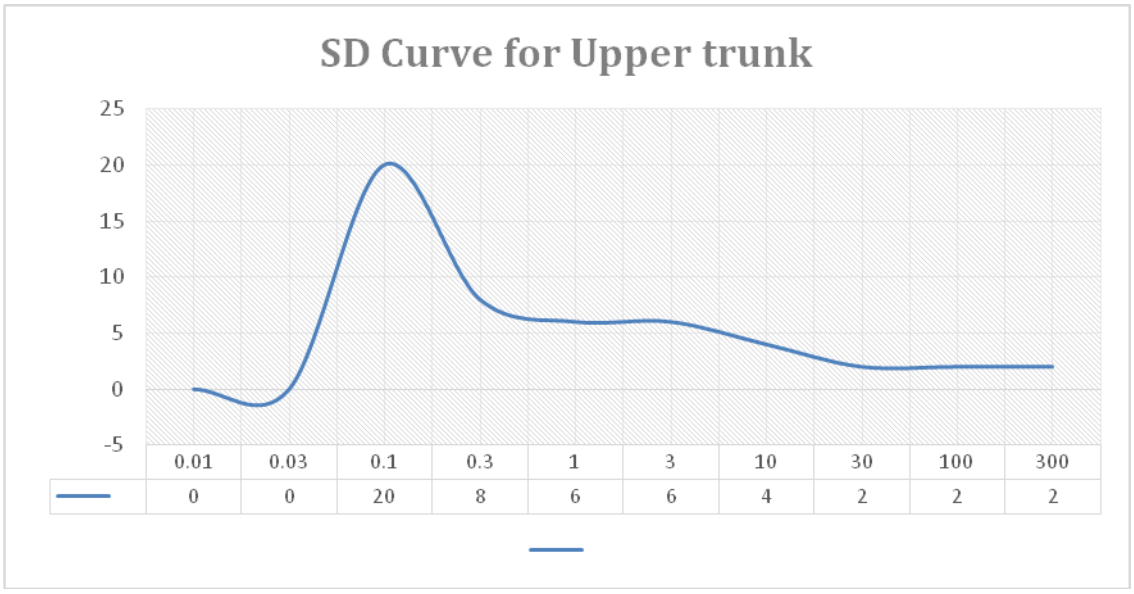
Graph 7



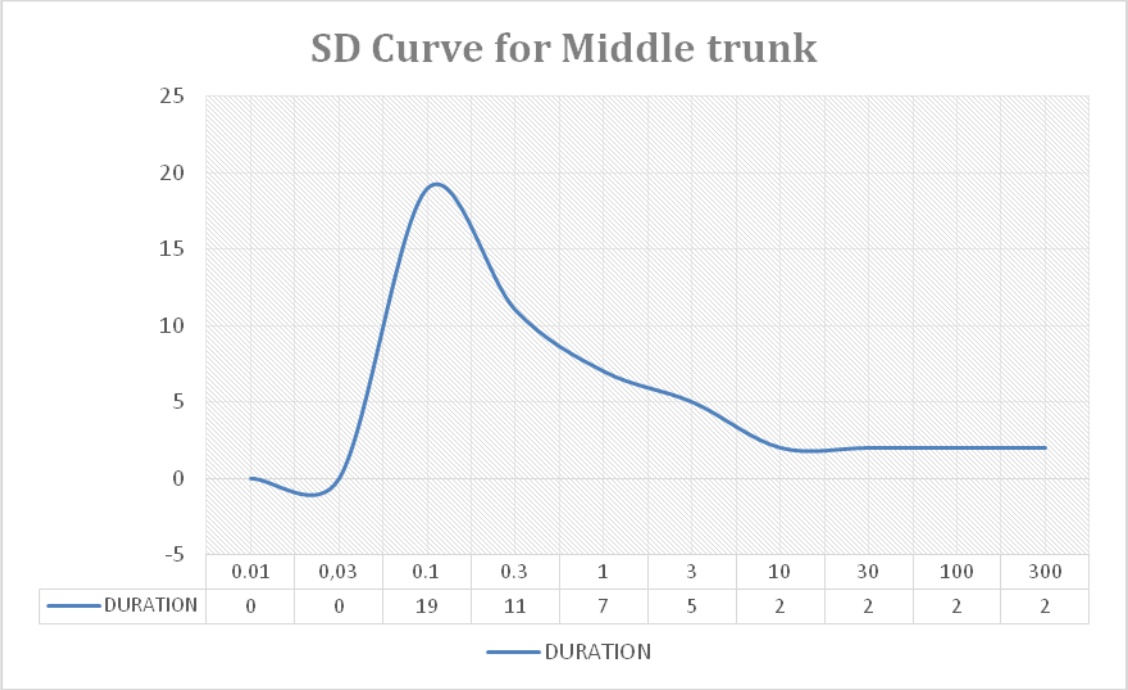
Graph 8



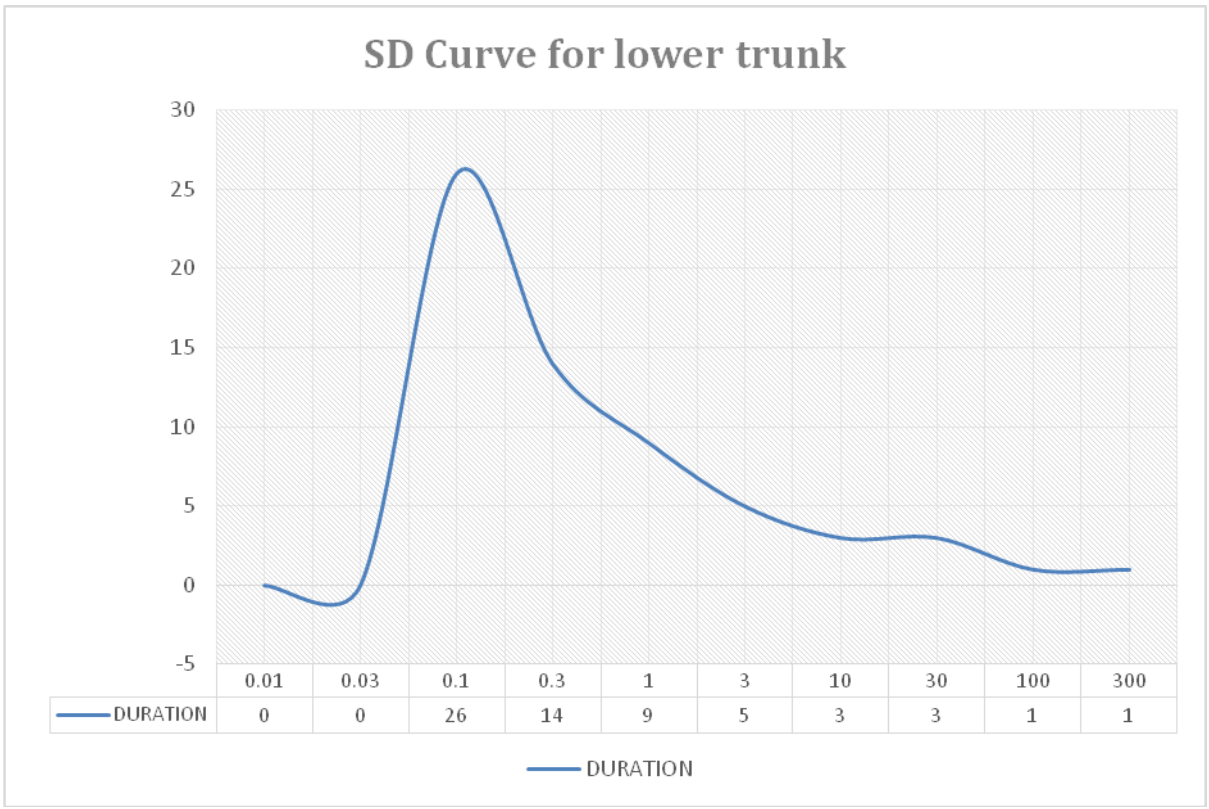
Graph 9



Graph 10



Graph 11



Graph 12

DISCUSSION

Nicholas Zachariades, Michael Mezitis, Constintine Mourouzis, Demetrius Papadakis, Athena Spanov (2006) suggests that open reduction is the first treatment choice for condylar fracture with displacement into middle cranial fossa.[23] The evolution of open reduction in condylar fractures began with the use of transosseous wiring by Thoma in 1945. Kirschner wires were then employed for fixation of bony fragments in 1952. The use of the "lag

screw" was introduced by Eckelt and Gerber in 1981 [7], and the concept of application of mini plate osteosynthesis for condylar fractures was established by Koberg and Momma in 1978 [8]. At present, the most frequent protocol followed is the use of titanium mini plates, but the current dilemma is the *choice of the optimal fixation device.* Some surgeons restrict themselves to single-plate placement along the posterior condylar border. The literature suggests that the single-plate technique is associated with complications like plate fracture with resultant displacement of the fracture fragments [9]. Batur Ercan et al suggests that coupling the position influences of electrical stimulation and nanotubular features on anodized titanium may improve osteoblast responses necessary for enhanced orthopedic implant efficacy.(26) Electrical stimulation as used in the study during the acute phase of bell's palsy is soft but may not have added value over spontaneous recovery state (Prisha Alakran, Threethambal Puckree)(2010).(24) Jin Kim, Jae Young Choi (2016) concludes that medication with electrical stimulation was significantly better than medication alone.(25)

The outcomes of SD Curve (sensory nerve) was approximately maintained from Chronaxie – 0.03 ms, Rheobase – 52 mA to Chronaxie – 0.03ms, Rheobase – 60 mA for upper trunk of facial nerve. For middle trunk, maintained from Chronaxie – 0.03 ms, Rheobase – 49mA to Chronaxie – 0.03ms, Rheobase – 49 mA and for lower trunk from Chronaxie – 0.03 ms, Rheobase – 59 mA to Chronaxie – 0.01 ms, Rheobase – 60 mA. The outcomes of SD Curve (motor nerve) was increased from Chronaxie – 0.3 ms, Rheobase – 52 mA to Chronaxie – 0.1 ms, Rheobase – 20 mA for upper trunk of facial nerve. For middle trunk, from Chronaxie – 3 ms, Rheobase – 49mA to Chronaxie – 0.1ms, Rheobase – 19 mA and lower trunk from Chronaxie – 10 ms, Rheobase – 51 mA to Chronaxie – 0.1 ms, Rheobase – 26 mA.

Clayton's Electrotherapy states that the SD Curve is usually seen rising at 1 ms for normal innervations. For complete denervation the intensity keeps increasing when lowering the duration below 100 ms and kink point represents partial denervation while one curve represents innervation and other represents denervation. The Chronaxie must be below 1 ms and Rheobase is 2 – 18 mA to be considered as innervations.(27) WG FriedLi, M Meyer states that the temporal integration properties and critical duration are useful parameters but require several measurement in low range of stimulus duration. Each laboratory SD Curves must be based on normal values and bilateral comparison might be indication of mononeuropathy.(21)

The outcome measures of FDI improves from 47 to 91. Vanswerringen JM, Brach JS discusses that the FDI subscores produces reliable measures with construct validity for measuring patient facial disability for individuals with disorders of facial motor system.(22)

CONCLUSION

This study concludes that the electrical stimulation shows improvements in both Facial movements and Electro-physiological values (SD Curve) and also states that the Titanium metal has some electrical properties and electrical stimulation can be given to the metal implanted area but with precautions. Even-though electrical stimulation shows improvement and no complication, there are no statistical evidence shows that electrical stimulation can be given over metal implanted area. Further studies needed in the future.

Declaration by Authors

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Conflict of Interest: The authors declare no conflict of interest.

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