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This project is focused at improving the diagnosis of peripheral trigeminal nerve (PTN) injury and to evaluate whether magnetic resonance neurography (MRN) can serve as a pre-surgical diagnostic and prognostic tool during patient management. Injury to branches of the trigeminal nerve is a well-known risk of dental and oral procedures. Molar tooth extractions alone account for 60% of these nerve injuries and it alone results in more than 11 million patient days of "standard discomfort or disability"—pain, swelling, bruising, and malaise. Application of the Sunderland classification is a standard approach to stage the extent of nerve injury that assists in prognosis and determination of treatment strategy. Early diagnosis and timely management of PTN injury are essential for improved patient prognosis and the post-operative outcomes are negatively affected by older age, delayed treatment after injury and larger nerve gap. Clinical neurosensory testing (NST) is the current pre-operative gold standard to corroborate the diagnosis of PTN neuropathy but is limited in diagnostic accuracy and its inability to delineate the anatomy for pre-surgical planning. In addition, the VAS (visual analog scale) and MRCS (medical research council scale) are clinically employed to assess pain, sensory dysfunction and recovery of these injuries. Magnetic resonance neurography (MRN) is an imaging strategy dedicated to the peripheral nerves that provides a non-invasive 3-dimensional map of neuromuscular anatomy. Routine MRN facilitates the detection of neuropathy by showing alterations of nerve caliber, identification of neuroma, and abnormal intraneural T2 signal intensity ratio (SIR). In addition, diffusion tensor imaging (DTI) aids in functional evaluation of the intraneural patho-physiology and augments routine MRN for the diagnosis of neuropathy. The overall goal of this project is to prospectively test the MRN and DTI augmented MRN (aMRN) in the classification of degree of PTN injuries with respect to surgery and histopathology, and to utilize the routine MRN and aMRN findings to predict patient outcomes. This pilot project is divided into three aims, which will evaluate important diagnostic and management issues in this domain. In Aim 1, correlation of routine MRN and aMRN (MRN plus DTI) determined five Sunderland types nerve injuries will be tested with the reference standards of surgical and histopathology findings. In Aim 2, MRN and aMRN derived Sunderland classification of PTN injuries will be correlated to the current reference standard, NST. In Aim 3, the predictive value of MRN, aMRN and NST will be determined with respect to patient outcomes at 3- and 9-months intervals post-surgery. A multi-disciplinary team has been assembled to execute this research project led by MRN expert, physicist, and an experienced oral maxillofacial surgeon. The research team will have access to the state of the art software and hardware capabilities at UT Southwestern to accomplish this project. If successful, this project can lead to significant advancement in the management of peripheral nerve injuries by generating determinants for outlining treatment strategies. The innovative MRN technology should enable prospective pilot data collection aimed at garnering extramural funding such as NIH for superior and objective diagnosis of PTN injuries and has the potential to provide surrogate imaging markers in predicting patient outcomes & prognosis.