INTRODUCTION

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Face expresses core feelings. Facial expression reveals an individual to the environment and the facial traits characterize individuality. Integrated with the feelings of joy, fear and anguish, emotions are expressed as an essential part of communication. Integrity of the neuromuscular co-ordination determines the psychologic and social status of an individual (Wolman, 1977). The motor nucleus of the facial nerve which exhibits control over the diversity of facial movements is situated in the ventral part of the pontine tegmentum.

In mammals, the efferent cranial nerve nuclei of brainstem arise from a common cell column. During development, the facial neuroblasts belonging to the special visceral efferent column migrate ventrolaterally to lie close to the spinal nucleus and tract of the trigeminal nerve. This migration of neuroblasts towards the major source of stimulation was noticed by Kappers (1908) and he named this phenomenon "Neurobiotaxis".

The early migration of neuroblasts of facial nucleus has been studied in the cat (Windle, 1933); monkey (Hauser and Streeter, 1941); rabbit (Kimmel, 1940) guinea pig (Lavelle, 1956); white rat (McAlpine, 1959); chick (Guthrie and Lumsden, 1992; Chen, Fan and Nayak, 1992); and bovine (Ruhrig, Hummel, Hild and Goller, 1992) during embryonic and early foetal stages. However, there are not many studies on the human foetus (Streeter, 1908; Pearson, 1946; Jacobs, 1971; Nara, Gotu, Nosaki and Maekawa, 1989). Since there was only limited information regarding the human foetus, and the theory

of neurobiotaxis has been questioned (William, Warwick, Dyson and Bannister, 1989) we decided to study the morphologic and cytologic changes exhibited within the facial nucleus of the human foetus from 8 to 36 weeks of gestation using qualitative and quantitative methods.

Facial nucleus in man is more differentiated than in other animals, and is the largest among the motor cranial nerve nuclei (Brodal, 1981). The adult human facial nucleus was studied and its topography and cytology were described by various authors (Riley, 1943; Buskirk, 1945; Olszewski and Baxter, 1954).

Hauser and Streeter (1941) described the development of facial nucleus in early Macaque embryos. Willis (1962) commented that this was closely similar to that of human embryos and so studies on monkeys can be of great value. So in the present study, growth of facial nucleus in the foetus, newborn and adult bonnet monkey, *Macaca radiata* was also undertaken.

Many retrograde labelling substances such as Horse Radish Peroxidase (HRP), Cholera Toxin - B (CTB), Wheat Gram Agglutinin (WGA), Fast Blue (F.B), Diamidino Yellow (D.Y), Rhodamine Microspheres (R.M) and the Conjugates of HRP have been used to trace the central nucleus of origin of cranial nerves (Horikawa and Powell, 1986). However, recently another fluorescent substance (DiI) a lipophilic carbocyanine dye was used in live and fixed neural tissues as a potential tracer (Wadhwa, Hayaran and Bijlani, 1991). In the present study also the tracer DiI was used to trace the facial nucleus in the adult bonnet monkey.

Of all the cranial nerves, the facial nerve is most commonly affected by trauma which leaves behind severe sequelae (McGovern, Thompson and Link, 1966). According to Bento, ~~and~~ Miniti and Ruoco, 1985 ~~(1989))~~, 43% of facial paralyses are traumatic in their origin. Diagnosis and treatment of facial paralysis have so far been the subject of very extensive studies which demonstrate the striking interest in this cranial nerve.

Transection of facial nerve results in retrograde reaction within the nucleus. The nerve cells undergo complex anatomic (Cammermeryer, 1963) and metabolic (Hall, Wilson and Stone, 1977) changes. If the integrity of the nerve trunk has not been disrupted, satisfactory restoration of functional activity can be anticipated. However, when the continuity of the nerve has been broken, recovery is poor, and the spontaneous return of movements of the face following surgical resection of the facial nerve, without grafting, is puzzling (Boyle, 1966). The experimental work in this study is an attempt to assess the degree of atrophy within the facial nucleus, the nerve and also the muscles supplied by the nerve at different post traumatic periods.

Monkeys were chosen as a primate model for experimental work because their grimace like facial expressions can be observed easily (Boyle, 1966). Moreover, there seems to be no available literature on such work on the locally prevalent species *Macaca radiata* which is the most commonly used primate model for experimental work in Tamil Nadu. Facial expression results from the co-ordinated action of facial muscles innervated by the branches of facial nerve. There is no essential difference between experimentally produced lesions and

those which occur in human cases (Brodal, 1981). But before transections of the nerve are undertaken, the course of the facial nerve and the distribution of its branches need to be clearly understood. So, the intra and extracranial course of the nerve in the monkey was carefully dissected and the muscles supplied by it were noted.

To summarise, the present investigation includes

a) Tracing the position of the facial nucleus during human foetal development and its cytology in the human adult.

b) Observation on the growth changes in the morphology and cytology of facial nucleus in the foetal, newborn and adult stages of bonnet monkey, *Macaca radiata*.

c) Dissection of the entire course of facial nerve in the adult bonnet monkey.

d) Tracing the facial nucleus in the adult monkey using fluorescent tracer DiI.

e) Evaluation of the effects of experimental transection of the facial nerve in the bonnet monkey.

Permission for use of experimental & human material

Ethical committee's approval was obtained before experimental works on monkeys were undertaken. The necessary permission was also obtained for using aborted human foetuses and the postmortem human adult material for the study.