

ULTRASTRUCTURAL FEATURES OF MACROPHAGES IN PERIODONTAL DISEASE

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치주질환시의 대식세포의 미세구조

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회 상 목

.....>국문초록<.....

치주질환 발생시의 대식세포의 형태적 변화 및 기능적인 상관관계를 연구하고자 성견 5마리를 사용 실험하였다. 실험동물을 전신마취한 후 상하악 우측 제 1 및 제 2 소구치의 치경부에 0.3mm 굵기의 wire를 4주간 결찰하여 인위적으로 치주염을 유발시켜 실험군으로 하였고, 동일동물의 좌측 제 1 및 제 2 소구치를 대조군으로 하였다. 실험군 및 대조군의 치아협측치은을 0.5×0.5×1mm의 형태로 절제하여 전자현미경적 관찰을 위한 통법의 조직처리를 한 다음 관찰하였다.

그 관찰 결과를 보면 다음과 같았다.

1. 실험군의 치은의 고유층에 탐식성 돌기를 가진 많은 대식세포들이 출현하였다.
2. 변성된 교원 섬유군 인접부위에 *phagocytic vesicle*을 가진 대식세포들의 세포질內에 지방과립 및 잔존물들을 볼 수 있었다. 한편 *RER* 및 *Golgi complex*는 매우 적었다.
3. 세포막은 그 기능상으로 많은 *ruffles or folds*를 나타냈으며 이 물질을 포식하는 양상을 띄기도 하였다. *pinocytotic activity*를 띄는 대식세포들도 보였다.
4. 신생섬유아세포 주위에 밀접한 관계를 띄고 대식세포가 나타났으며 상호 유사하다. 대식세포에는 많은 *residual body*가 나타났고 *RER*은 매우 적었다.

Introduction

Macrophages may be resident in connective tissue, or they may be of hematogenous origin, but cells from the two sources are indistinguishable morphologically. The cells are large compared to ordinary cells and emigrate from the blood into the connective tissue when required.

Macrophages are ovoid but may be elongated or angular when crowded by other tissue component. Han and Leeson(1965) distinguish them from fibroblasts by their smaller, more intensely stained and indented nucleus, which tend to be located towards one end of the cell with its convex surface facing the cell margin.

At higher magnifications of the electron microscope, the plasma membrane is seen to be thrown up into short projections, fold and clefts. They also present a

spectrum of morphological types which depend upon their age, degree of stimulation and the phagocytic activity. The young newly differentiating macrophages (referred to as "activated") contain well-developed Golgi complex and numerous lysosomal granules. Mitochondria, granular and smooth endoplasmic reticulum and free ribosomes are relatively abundant. Older macrophages contain numerous phagosomes filled with material ingested from the extracellular space.

Macrophages may play an important role in the pathogenesis of the disease. And they may be related to the tissue damage observed in chronic inflammatory and immunopathologic lesions through their ability to synthesize and release lysosomal hydrolases.

The purpose of this study is to observe characteristic morphological features of macrophages when they are in active function during the course of chronic inflammatory periodontal disease. To observe at fine structural level, the author performed electron microscopic view.

Materials and Method

Five dogs weighing 10–12kg were used in this experiment. To induce general anesthesia, intravenous injection of Nembutal sodium (30mg/kg B.W.) was performed and wire ligation around the cervical neck portion of crowns on the right first and second premolars of the both jaws. Left side was designed as control. The ligated wire was of 0.3mm in diameter. 4 weeks after the experiment, clinical observation on the signs of artificial periodontitis was made. The animals were fed with soft diet during the experimental period.

After sacrifice with intravenous injection of lethal dose of Nembutal sodium, tissue specimen was taken from the labial gingiva of the experimental teeth. Specimen consisted of $0.5 \times 0.5 \times 1$ mm in diameter. It was immediately fixed in 1.0% paraformaldehyde-glutaraldehyde for 2 hours, postfixed in 2.0% osmium tetroxide for 2 hours and embedded into Epon 812. The embedded block was sectioned by LKB 8800 ultratome and double-stained with 2.5% uranyl acetate and lead citrate. The thin section was examined with AEI Corinth 500 Electron Microscope.

Observation

Large numbers of macrophages with phagocytic processes were seen in the gingival lamina propria of the experimental site. (Fig. 1) Near the degenerated collagen fibrils, macrophages containing phagocytic vesicles were seen with large numbers of lipid granules and residual bodies within the cytoplasm. It was also evident that this cell had poor RER and Golgi complex in their cytoplasm. (Fig. 2)

In close contact with connective tissue collagen fibers, macrophages showed large numbers of engulfed dense residual bodies and poor RER. (Fig. 3) Multiple features of macrophages were shown in close relation to active form fibroblast and collagen fibers. (Fig. 4)

In inflamed gingiva, typical form of macrophages was shown illustrating the

heterogeneity of its cytoplasm, which has numerous lysosomes, phagocytic vesicles and residual body. The ruffles or folds on its surface were immobilized with the fixative in various stages of their pinocytotic activity. (Fig. 5)

Well-developed fibroblast was seen with plenty of RER and elongated nucleus. Newly formed collagen fibrils were seen around this fibroblast. Concomitantly, macrophages appeared near this newly formed fibroblasts. This macrophage had large number of residual body and poor RER in their cytoplasm. (Fig. 6)

Discussion

Recent studies have demonstrated specific membrane receptors for certain components of complement and antibody, and nonspecific receptors which bind denatured substances. Structural identification for this receptors was unable to observe, but it has much to be studied further.

Characteristic features which distinguish macrophages from fibroblast are; their rich content of vacuoles that contain ingested matter and which may be lysosomes; the presence of irregularly shaped, very dense amorphous masses in the cell; a relative paucity of RER; and the absence of marginal intracytoplasmic filaments. The observed features of macrophages in this experiment were consistent with those features mentioned above.

Their ruffled surface and cytoplasmic projections indicated their role in the inflammatory process. Macrophages are ameboid motile cells which phagocytose damaged tissue and bacteria. Their surface is deeply ruffled and shows as process when sectioned. The surface contains a mechanism which enables the cell to recognize foreign bodies. Particles coated with specific antibody are rapidly phagocytosed, presumably reflecting the presence of immunoglobulin receptors of the cell membrane. This is also another mechanism which appears to operate in the absence of specific immunoglobulin. The fundamental biologic attribute of these cells is their capacity for destruction and degradation of ingested material. This is based on their high content of lysosomes. Lysosomes are discrete membrane-bound intracellular structures which contain hydrolytic enzymes. Phagocytosed material is first segregated within vacuoles which subsequently fuse with lysosomes, thus allowing digestion to occur. These are so-called "secondary" lysosomes.

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Explanation of figures

Fig 1: Large numbers of macrophages were showed in the inflamed gingival lamina propria in the phagocytic process. ($\times 950$)

Fig 2: Near degenerated collagen fibrils, phagocytic vesicles Containing macrophage was scen with large number of lipid granules and residual body in their cytoplasm. it was also revealed that this cell had poor R.E.R. and Golgi a Complex in their cytoplasm ($\times 4400$)

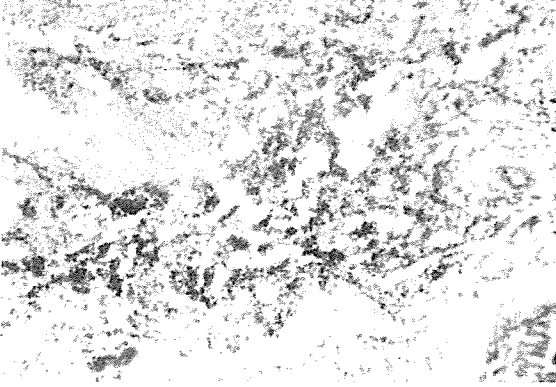
Fig 3: In close contact with connective tissue collagen fibers, macrophage come into view with large numbers of engulfed dense residual body and poor R.E.R.

Fig 4: Multiple advent of macrophage was shown to close contact with active from fibroblast and collagen fibers.

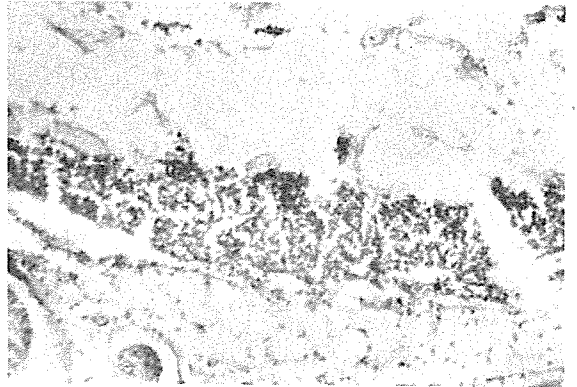
Fig 5: In inflamed guigiva, typical form of macrophage was revealed with illustrating the heterogeneity of its cytoplasm, which has numerous lysosomes, phagocytic vesicles and residual body. the ruffles or folds on its surface were immobilized by the fixative in various phages of their pinocytotic activity.

Fig 6: Well developed fibroblast was revealed with plenty R.E.R. and elongated nucleus. newly formed collagen fibrils were seen around this fibroblast. Concomitanthy, macrophage appeared near this newly formed fibroblasts. this macrophage had large number of residual body and poor R.E.R. in their cytoplasm.

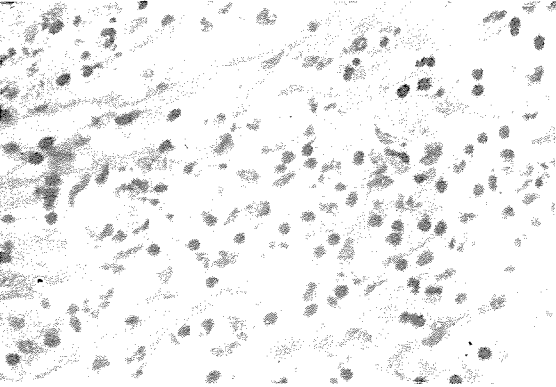
論文写真附图



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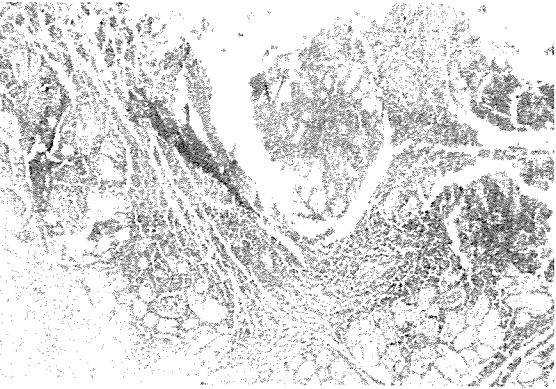
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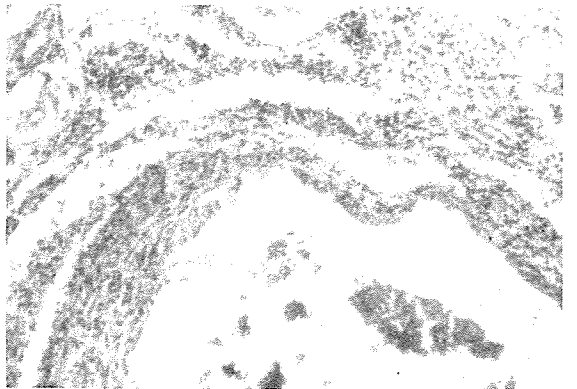
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