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Experimental Examination of Vascularized Bone Tissue Based on Combined Mold Technology

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Abstract: How to improve the bone healing speed and bone healing quality of large bone tissue is the current research hotspot. Capillary vascularization is the initial and most basic link, which has the decisive influence. If it is not possible to form an effective blood circulation, the manufacture of related bone tissue engineering materials can only be limited to a small range. Only by further exploring the status and method of action in the healing of bone tissue can we provide a useful method for solving their doubts. The purpose of this paper is to establish a research model for vascular nerve that can be used in bone tissue mechanisms, using composite mold technology to study vascularized bone tissue, observing the effects of sensory nerve bundles and motor nerve bundles on the growth and reconstruction of bone tissue. Whether the capillary bundle has a subtle influence on the development of bone tissue when the bone healed in bone tissue. To explore the role of vascular nerve in bone tissue construction, and to analyze the effects of different types of nerve fibers on bone healing. In this paper, by preparing vascular nerved bone tissue experiments, compared the influence of nerves and capillaries on bone healing in regenerated bone healing tissues from tissue immunology. And use immunological staining to initially detect the mechanism that promotes bone healing. Using the combination of mold technology and surgical methods, applying sensory nerves, motor nerves, and the combination of the two into the bone healing tissue, analyzed the influence and mechanism of nerves on bone healing in bone healing tissues. The results of the study show that bone tissue is originally accompanied by the growth of nerve fibers and the growth of nerve fibers is parallel to the process of bone healing. During the healing of bones in bone tissue, the sensory nerves or sensory nerves contact the motor nerves can promote bone healing. However, there is no obvious promotion effect when simply placed in the motor nerve, and the regenerated nerve fiber is very meaningful for the new capillaries in bone healing.

1. Introduction

Mold technology is the basic equipment for industrial production and plays an important role in production [1]. According to statistics, in the aviation, life, scientific research and other regions, the components made by the combination mold account for more than 70%, and in the computer, camera and other supplies, the parts manufactured by the mold account for more than 75% [2]. Today, a relatively comprehensive mold technology system has been created, and the organizational structure, technical structure, and product structure of the enterprise are becoming more and more reasonable. The mold production characteristics are that the mold is a single production item, and the mold industry is also a unique order-type manufacturing industry [3]. The mold industry can only design, procure, produce, test and test products after receiving an order. Therefore, for the mold industry, each mold is a unique product that needs to be designed independently. Its size, texture and size are very different [4]. A set of molds often consists of hundreds or even thousands of parts. The difficulty of design and production is very large [5]. The characteristics of the mold production process are: poor production stability. Due to the variety of random orders and customer requirements, the production plan is easily disturbed, so that there are various different points in the plan, and the production method has strong instability [6]. The time and interval of production is very long. The degree of imagination will be different because different people have different opinions [7]. In terms of ideas, the design of each mold is different and cannot be used continuously. There are many important points that affect the final quality of the mold. Therefore, the final implementation of the combined mold depends on the experience of the professional designer to solve the problem. In terms of production, since the mold consists of many parts, each part contains many processes, the production process is also very dependent on the experience of the processor. These characteristics have brought huge obstacles to the production of molds, and the market has also made relative changes in the need for combined molds [8]. The demand for higher quality and quantity is an important feature of the current demand for the combined mold industry. Mold products are developing in the direction of scale, precision, complexity and multi-function, and put forward higher requirements for the production of molds. It requires high production efficiency, short production cycle and high processing accuracy [9].

With the exploration of the distribution and function of nerves in bone tissue, the influence of nerve factors on bone growth and recovery has been paid more and more attention [10]. Nerve tissue is mainly distributed in the periosteum, and the fine bone marrow and non-myeloid nerve fibers are accompanied by the capillaries of the necessary substances to enter the bone and bone marrow, and are located in the space around the capillaries of the Haval's tube. The influence of nerve tissue on bone development, growth and metabolism plays a broad role [11]. The development of nerve fibers is accompanied by the development of skeletal organs, and the growth of nerve fibers is parallel to the process of ossification of bone [12]. Any changes in bone tissue, nervous system, and capillary system during bone recovery can result in corresponding changes in the other two systems. They are an interactive, mutually constrained whole [13]. Whether the nerve depends on capillary growth is a prerequisite theory for studying the nerve growth of bone tissue. It is currently believed that nerves play a common role in the nerves of bone tissue [14]. In the process of bone healing, there is a unique neurological aid, which occurs earlier than capillary growth, and the development of peptide nerves is closely related to capillary growth. The orientation and stage of neural development are strongly associated with the differentiation of bone cells [15].

Blache and other scholars believe that sensory nerve fibers and sympathetic nerve fibers control periosteum, mineralized bone and bone marrow, most of which are related to capillaries. Cortical bone is different in the range of dominance of sensory and sympathetic nerves [16]. Active sites of bone metabolism, such as the tarsal plate and the fracture end, are often subjected to a large amount

of mechanical stimulation and load. It has the highest metabolic rate and bone turnover. It is the most densely distributed area of capillaries in the various bones and the most densely distributed sensory nerves. The distribution of sympathetic nerves is different from that of sensory nerves. The sympathetic nerves are scattered in the marrow cavity, followed by mineralized bone and periosteum [17]. Liu et al. showed that the bone nerves were presented by nerve fibers (including myelin and unmyelinated nerve fibers) and non-peptide nerve fibers by immunohistochemistry. Neurons can grow protein material and transport through axonal channels; neurons are the cells of choice for the absorption and transport of tertiary amino acids [18]. Patrick and other scholars have explored the role of the nervous system in the development and development of various tissues, organs and systems in the human body. The nervous system makes each part of the body a collective, coordinating the functioning of various organs. Neural control is extremely important for the control of bone development and metabolism [19]. In addition to the typical nervous system tissue, there are complex nerves that directly control bone tissue. Compared with traditional neurotransmitters, special neurological substances are extracted from large precursor proteins. The various genes that transcribe these proteins often have incomprehensible genetic institutions. Gene display of nerves also occurs in cells or special tissues [20].

In this paper, the effects of nerves and capillaries on the bone healing of bone tissue in regenerated bone healing tissues were compared by general and tissue immunology by preparing vascular neurons for bone tissue experiments, and preliminary methods were used to detect them by immunological staining. The mechanism that promotes bone healing. Using the combination of mold technology and surgical methods, the sensory nerve, motor nerve and the two are used in the bone healing tissue to analyze the influence of nerve on bone healing and its mechanism in bone healing tissue.

2. Vascularized Bone Tissue

2.1. Seed Cells

(1) Schwann cells: Schwann cells derived from embryonic neural-derived spinal cells are the major interstitial cells of the peripheral nervous system after the nervous system matures. Under normal circumstances, Schwann cells form a myelin sheath around the axons, protecting and supporting the growth of axons. At the same time, Schwann cells are also involved in the homeostasis of the relevant environment surrounding the axons of the nerves. Without the protection and support of Schwann cells, the nerves will not work properly. This kind of cell is also involved in all the processes of recovery of various nerve damages and plays an important role. When the peripheral nerves are frustrated, the damaged and degenerated protrusions and pith are swallowed and cleared by Schwann cells and corresponding phagocytic cells. At the same time, the ever-branched and proliferating Schwann cells form a unique Bungner zone on the nerve capsule, which not only removes the obstacles to the development of new synapses, but also provides a better attachment orientation to guide and promote synaptic growth. In addition, Schwann cells can continuously express and disperse various growth factors (NGF) and other representative receptors, diffuse more membrane components, and continuously induce, stimulate and adjust the growth of myelin. Synaptic growth.

(2) Stem cells: There is a strong proliferation limit and the potential to develop in multiple directions. In special cases, it can be guided to become a special nerve cell. Varieties of Schwann cell-like cells can also be used to promote synaptic growth. In addition, the specificity and universality of various stem cells of the latent cells make them more useful in the healing of bone tissue. Compared with Schwann cells, stem cells are not only easy to evade host immune recognition, but also have a certain immunosuppressive effect, avoiding the occurrence of immune

rejection after transplantation. Different potential cells have different advantages in restoring peripheral nerve frustration. In general, stem cells have the advantages of no ethical restrictions, easy availability, easy proliferation, easy transfection, and low immunogenicity.

(3) Biomaterials: The original materials of the organisms are constantly advancing and improving with the times, which has effectively promoted the further understanding and development of bone tissue engineering. At the same time, with the continuous exploration of bone tissue, unusual requirements for biological materials have been issued. To be specific, the researcher's thoughts and understanding of the nerve area are full. The biomaterial should match the following requirements: the first material it chooses must have very good mutual solubility and relative safety. It is guaranteed that there will be no mutual exclusion and different degrees of damage to the body after regenerating the bone healing tissue. Secondly, it should have a good vitality to promote the development and adsorption of seed cells, so that it can make better use of its greater vitality. Third, the infiltration wall should have an item that is selected to pass through the membrane to ensure the vitality of the seed cells and the absorption and metabolism of various essential substances, and the composition of artificial capillaries. Fourth, the supply of materials should have a three-dimensional structure suitable for the development of synapses, and sufficient roads for the reborn nerves. Fifth, the material should also have excellent mechanical properties in order to promote the elements needed for nerve regeneration. Sixth, after completing the task of the nerve stent, the material should be completely degraded and discharged from the body. The current bone tissue experimental production engineering products can be divided into natural materials and synthetic materials made by human wisdom. These two materials have their own advantages and disadvantages.

Natural biomaterials have been used to make artificial nerves. Materials that have been made in nature include fascia, thick veins, decalcified bone catheters, coatings, and skeletal muscles. Although the source is different, it has the advantages of high biosafety, good histocompatibility, high Hydrophilic and high cell affinity. Among so many synthetic materials, polyglycolic acid (PGA) and polylactic acid - glycolic acid copolymer (PLGA) are the most mature synthetic materials in the field of tissue engineering artificial nerves.

2.2. Tissue Engineering Artificial Nerve Capillary

(1) With the extensive use and variation of nanotechnology in various regions and the use of genetically altered cell orientation techniques, tissue experimental bone engineering has made great progress in restoring peripheral nerve damage with human intelligence. After the peripheral nerve regeneration microenvironment and local blood supply damage, in order to achieve a satisfactory neurological recovery effect, in addition to providing the necessary essential materials for nerve regeneration, there is also a living environment that is conducive to the rebirth of nerve regeneration. This is closely related to local blood supply. Early capillary vascularization can provide enough of the necessary materials for the transplanted Schwann cells to promote the growth of new axons. On the other hand, it can reduce the production of collagen fibers in the body and promote the passage of new axons. In addition, early capillary vascularization of nerve grafts can also cause macrophages to accumulate from the blood, which helps to rapidly remove the degeneration products of myelin and axons after nerve injury, thus facilitating proximal synapses and further to the distal Synaptic growth and development enjoy more adequate roads.

(2) There are two different methods for capillary endothelial cells to regenerate nerves, nerve movements, and capillary movements: The neuromorphology is outward longitudinal capillary, occurring 3-5 weeks after exercise, and the neuromorphology is the inner plexus capillary, it can last for about 22 weeks. The re-generation of capillaries is mainly due to the growth of mature

capillary endothelial cells through the connection of micro-capillary. Capillary endothelial cells are endothelial progenitor cells transformed by bone marrow mesenchymal cells and are an important component of capillaries. Uniformly growing on the surface of the capillaries, the most important oozing obstruction grows in the blood between the fluid and the wall of the tube. Capillary formation involves two mechanisms: capillary efflux and capillary formation. Capillary birth is mainly the way in which endothelial cells hydrolyze the capillary basement membrane, produce and then proliferate, and finally form young capillaries.

(3) Exogenous nerves must be given essential substances: the various substances that give essential nerves can not only choose to give impulsive ability to make the nerves have reproductive influence, but also promote synaptic growth and development, and promote the nerves. Growth, development, and the implementation and performance of various special abilities, even in the adjustment of the existence and death of the nerve body, cannot be ignored. They are good at restoring nerves in all aspects of frustration and can be implemented in nerve support. The application of essential material factors from the outside is another useful method.

2.3. Tissue Engineering Artificial Nerve to Promote Capillary Vascularization

(1) The bone mechanism is artificially neurovascularization. Finally, the artificial nerve that wants to promote the migration can construct the capillary network project as early as possible, thereby constructing the internal circulation system. In practical applications, the surgical method is used to make the broken capillaries coincide with each other, and the capillary bundle is correctly and perfectly regenerated into the bone healing tissue to restore the nerve frustration. Inspired by this, we try to find a different capillaries, move and place around the moving nerves, or become an artificial nerve ending in the vascular bundle. Mainly to maintain the stability of the supply blood flow and the continuity of the transfer, restore the nerves after the transfer of the nerves, and the nerves of the transplanted nerves are in a relatively early stage, the final goal is to effectively promote the regeneration of axons. Capillary endothelial cells grown with artificial cells can obtain more capillary growth factors, and capillary endothelial cells can proliferate and become new capillaries after regenerating bone healing tissue materials.

(2) Morphological and histological observation of nerve formation: the nerves accompanying the capillaries in the bone tissue are mostly unmyelinated nerve fibers, bone marrow nerve fibers are rare. The nerve fibers of some bone parts are composed of myelinated nerve fibers with a radius of 5 μm and unmyelinated nerve fibers with a radius of 1-2 μm. They are all distributed near the capillaries. The nerves of humans and beasts are distributed in the thick veins and around the capillaries. Branches like tree shrews can be seen in the bone cavity. There are three kinds of nerve fibers in the bone, which are not myelinated nerve fibers. They are distributed around the capillaries and can reduce the diameter of the capillaries, so that the speed of blood flow is controlled. The other is a shell-like nerve fiber that is mainly scattered around the capillaries and bone cavities. The last one is a nerve fiber without myelin, which is distributed in a mesh-like neural grid around the bone, distributed in the bone surface and bones, and the bones are more distributed. The meniscus is mainly dominated by many nerves at the junction of the osteochondral. These unique nerves pass through the nerve branches and finally emit matching neuroactive substances, which act on the site of action and affect the metabolism of bone cells. Many special nerve substances have the role of nerves to give essential substances. Although they are not as diffuse as typical neurological substances, they can spread to nearby cells because of their slower nature of death, long-term and widespread effects, and they are most importantly distributed through the side, so they are suitable for adjusting the rhythm and lasting effects. Change is a powerful complement to the classic fast and precise adjustment of neurotransmitters.

3. Experiments

3.1. Methods for Making Capillary Nerves Combined Experiments and Data Collection

(1) Main experimental equipment: four-hole steel iron plate, drill bit, hand saw, steel scale, angle hook, blood pulse clamp, screw, bone and outer membrane exfoliation machine, electron microscope, sterile working instrument, carbon dioxide Box, distillation machine, disinfection equipment, electric furnace, temperature maintainer, refrigerator, washing machine, speed centrifuge, dialysis equipment, etc. Heparin (400u/m1), ascorbic acid(40ug/m1), dexamethasone(10^{-7}mol/L), sodium glycerophosphate (10^{-2} mol/L), trypsin (0.14%), fetal calf Serum (9%) were fed healthy New Zealand white rabbits, 37 years old, weighing 1.0-1.4 kg.

(2) Experimental method: 25 New Zealand white rabbits were used in the experimental group. After returning, the cage was kept in 0.5w to adapt to the environment. If it is arranged from the perspective of weight, 24 numbers are extracted from the unordered series, and the numbers are arranged in order from small to large to obtain a series R, and R=l-8 is defined as group A, and R=9-16 is Group B, R = 17-24 were group C, with 8 animals in each group. Group A: only group of bone tissue group B: bone tissue + capillary bundle regenerated bone healing tissue group C group: bone tissue + sensory nerve bundle regenerated bone healing tissue group.

3.2. Bone Tissue Mechanism Manufacturing Method and Detection Method

(1) Preparation method of bone tissue mechanism: 37 intramuscular injections of atropine solution were used to anesthetize New Zealand white rabbits. Use three rabbits at a time. Take 3-4 ml of red bone marrow from the intestines and prevent blood clotting with 400 u/ml heparin. After solidification, the supernatant was centrifuged at 900 r/min for 9 min. The supernatant was inoculated into a DMEM whole culture base and inoculated in a 4 x 104/cm^2 culture flask. The culture was carried out once at 30℃ in an incubator containing 4% $C0_2$ humid air, the cells were washed with clear supernatant DMEM, and the cells were digested with 0.14% trypsin and 0.01% EDTA. The cell bodies were observed under an electron microscope until the cells were separated and descaled (up to 1-4 minutes depending on the temperature difference and time of digestive enzyme action). Cells are added to the complete culture to stop digestion. The suspended liquid obtained by digestion was centrifuged at 1100-1400 r/rain for 9 minutes in a high speed centrifuge. Discard the clear liquid above and add DMEM to the culture base. Re-suspend the cell suspension and mix well. After calculating the values, the cells are placed in a culture bottle for development. The liquid exchange was carried out once a day for 2 days. The cells were digested, centrifuged, and collected by the above method. Finally, the whole suspension liquid was placed in the β-TCP raw material (material format: 10 mm x 12 mm), and cultured in a 2 TC, 4% $C0_2$ incubator for 3-5 hours, and taken out. The culture bases all regenerate the bone healing tissue down the edge of the culture base. The raw material was covered for 1 week, and the bone tissue was regenerated into bone healing mechanism for bone damage.

1, 2, 3 rabbit thigh bone 1.5 cm long bone damage test production method in the right hind limb bone made a long incision shape, 4-6 cm, cut the skin surface, skin fat and deep fascia, along the muscle Separated from the inner thigh muscle to expose the thigh bone. Unlike the capsule to be cut into the bone tissue, a plate-like structure with a corrected shape is placed on the front side of the femur tissue (the curvature of the plate-like structure is about 4^0-7^0, in order to promote the curvature of the plate-like structure and the thigh bone to each other. Suitable) A good 4-hole iron plate. The drill bit is forced into and fixed with a nail. For higher stability, it can be wrapped with a screw net between every two nails. In the first two gaps of the iron plate, use a saw to break the side of the thigh bone, then measure the length of the thigh bone 1.0 cm, mark it with a marker and then

break the other side. After breaking, the bone capsule is removed to promote 1.0 cm bone tissue. The envelope was damaged, the incision was washed with sodium chloride solution and sewn with needlework, and then covered with gauze.

1, 2, and 4 capillaries and neuronal tissue engineering were used to restore bone damage in New Zealand white rabbits. In the anterior medial aspect of the femur of the rabbit, the middle and vertical incisions were made. The large saphenous nerve line is exposed to the three sides of the strand and separated layer by layer. The great saphenous nerve is the extension of the thigh nerve, accompanied by blood vessels. The great saphenous nerve is cut off after a certain length of freedom. The appropriate separation of the proximal nerve points is used to insert into the exterior of the bone tissue through the internal muscles. Two needles are placed in the interstitial space of the bone tissue, which acts as a sensory nerve to regenerate the skeleton healing tissue group. A small incision is made on the anterior side of the thigh bone, and the femoral capillary bundle is exposed and separated in each of the three sides of the femur. After a suitable length, we reconstitute the capillary bundle into the bone tissue of the bone healing tissue. The two needles are placed in the interstitial space of the bone tissue, and the capillary bundle is regenerated into the space of the bone tissue healing mechanism of the bone healing tissue mechanism, which is a capillary healing group. Only the bone tissue engineering mechanism in the bone damage is embedded in the β-TCP+ induced BMSCs complex, but the same treatment is done on the anterior side, and the separate capillaries do nothing. Wash the incision with sodium chloride solution and sew with needlework, then wrap it with gauze. After surgery, pay attention to intramuscular injection of penicillin 300,000 U per day, do not intermittently do 2 days.

(2) Test method: observe the postoperative condition of New Zealand white rabbits. Four animals were sacrificed at 3, 7, and 11 weeks after surgery. Cut the damaged side of the thigh bone completely, see the damaged area regenerate the long bone, match the side of the host bone and the mapping force of the surrounding fat. Cut biological tissue into pieces, place special chemicals, and embed with plaster and joining materials. Cross-cutting and slitting of bone damage. The thickness is 4 μm. HE and Masson staining. HE dyed into a special color and then carefully explored, you can use the data picture experiment to measure the bone damage area and regenerate the effective area of the bone healing tissue. Chemical staining of immune tissues using the SABC method. The experimental fragments of the changes revealed by CGRP and NPY served as positive comparisons. The PBS solution was used instead of the SABC solution as a negative control. The values of the dyed special colors are determined by image experiments, and then the general condition values of the fragments are calculated (the average value is inversely proportional to the immune response value).

4. Discussion

4.1. Gross Specimen Observation

(1) The results of the post-test results of the three groups A, B, and C

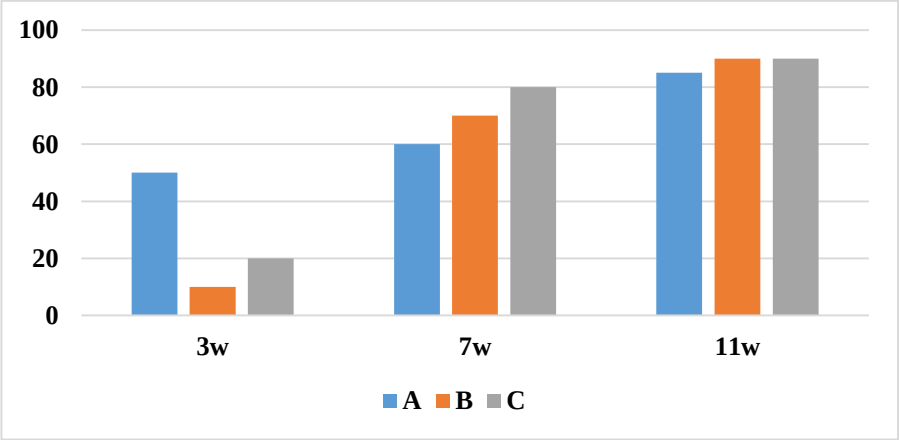

Figure 1. Connectivity between material and bone interface

The results of the post-test results of the three groups A, B, and C are shown in Figure 1.At 3 weeks after operation, the external contact between the group A and the surface of the raw material were surrounded by fibrous connectives. The contact surface of the material and bone can be folded up to 50%. The experimental group of group B was wrapped by a large fibrous callus, and the fracture on both sides was difficult to bend, reaching 10%. The surface of the material of Group C was wrapped by thin layer cartilage and fibrous callus, and the two ends were slightly broken by 20%. At 7 weeks after surgery, both groups A and B had a small amount of callus and fibrous tissue, 70% of the callus was wrapped by larger callus, and the surface of group C was surrounded by a thin callus. . The latter two groups are more difficult, and the junction between the two groups is blurred, and 80% is difficult to distinguish. At 11w after operation, there were less bone connections at both ends of group A. Group B and group C membranes were surrounded or replaced by outer membrane bone-like substances, and the interfaces at both ends were invisible, reaching 90%.

Comparative analysis of bone density

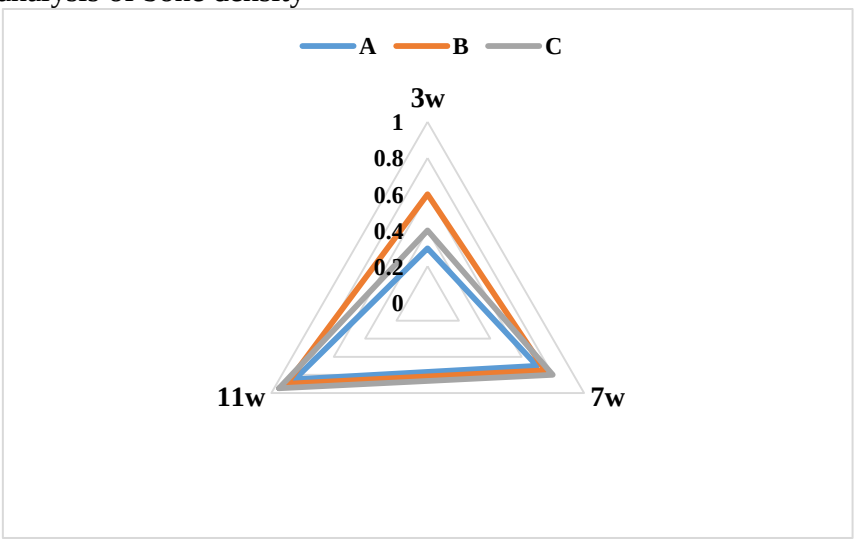

Figure 2. Comparative analysis of bone mineral density

Comparative analysis of bone density is shown in Figure 2, at 3w, group B was better than group A and group C, and there was significant difference. At 7w and 11w, group C was better than group A and group B. There is a big difference.

4.2. Tissue Immunology Observation

(1) Data analysis of regenerating the average percentage of bone defect area occupied by bone defects

Table 1. The average percentage of new bone sorghum in the area of bone defect

Group	Time (w)			Total	F value	P value
	3	7	11			
A	16.375±1.357	28.048±2.464	47.565±3.112	30.629±12.711	80.687	0.000
B	36.088±2.346	46.710±3.457	74.028±4.652	51.404±15.681	72.033	0.000
C	30.048±2.160	45.863±4.040	72.340±1.886	50.083±17.784	157.852	0.000
Total	27.170±7.864	40.711±8.383	64.236±11.767	43.706±17.589	104.635	0.000
F value	24.497	22.526	48.889	290.000	(F=2.077 P=0.019)	
P value	0.000	0.000	0.000	0.000		

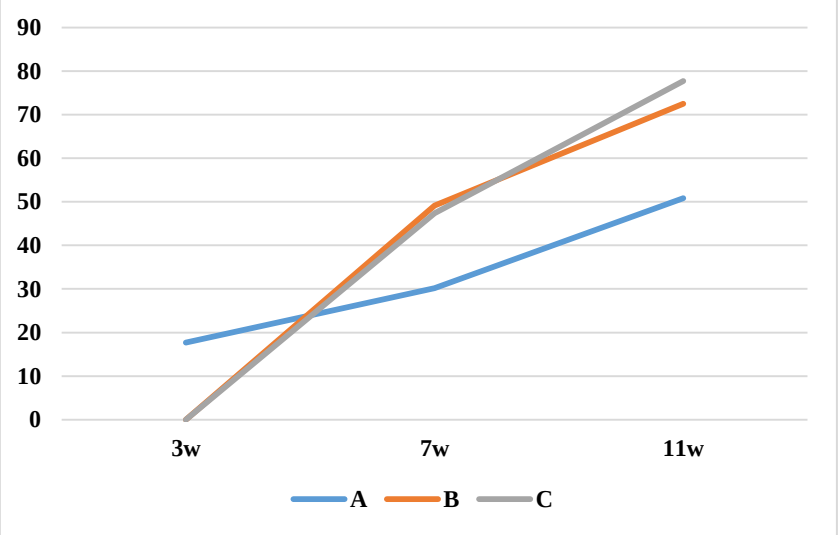

Figure 3. The average percentage of new bone sorghum in the area of bone defect

Data analysis of regenerating the average percentage of bone defect area occupied by bone defects as shown in Table 1 and Figure 3.Analysis of the regenerated skeletal healing tissue reconstituted bone healing tissue Figure 3 and Table 1 data analysis shows that with the development of time, the re-generation of long bone tissue has a different increase, the difference is data The effect ($F = 104.635$, $P < 0.000$), a greater number of comparisons showed that each group of 7 w of regenerated bone healing tissue was greater than 3 w, more than 7 w at 11 w. There was a significant difference in the amount of regenerated bone healing tissue in each group ($F=290.000$, $P<0.000$). From each time point, there was a significant difference in the amount of regenerated bone healing tissue at each point. The values of F are 24.497, 22.526, and 48.889, both of which are $P < 0.000$. There was a data study at each time point and in the nerve regenerating bone healing tissue ($F=2.077$, $P=0.019$). From the point of view, the LSD method is more convenient and clear. At 3w, the overall data of Group B is better than the overall data of Group A and the overall data of Group C. Group C is better than Group A; at 7w and 11w The B group and the C group were better than the A group, and there was no significant difference between the B group and the A group.

(2) Data analysis of regenerating the average value of CGRP in the bone healing tissue

Table 2. Average gray value of CGRP staining in new bone tissue

Group	Time (w)			Total	F value	P value
	3	7	11			
A	0.000±0.000	0.000±0.000	51.778±4.747	16.526±15.114	326.083	0.000
B	80.316±6.188	118.843±11.656	116.700±13.275	100.282±25.535	12.203	0.001
C	55.550±5.200	117.393±10.167	117.893±5.577	105.286±20.258	56.045	0.000
Total	48.259±36.23	78.378±58.222	95.451±32.348	74.031±46.725	94.292	0.000
F value	242.190	210.787	60.066	414.124	(F=15.375 P=0.000)	
P value	0.000	0.000	0.000	0.000		

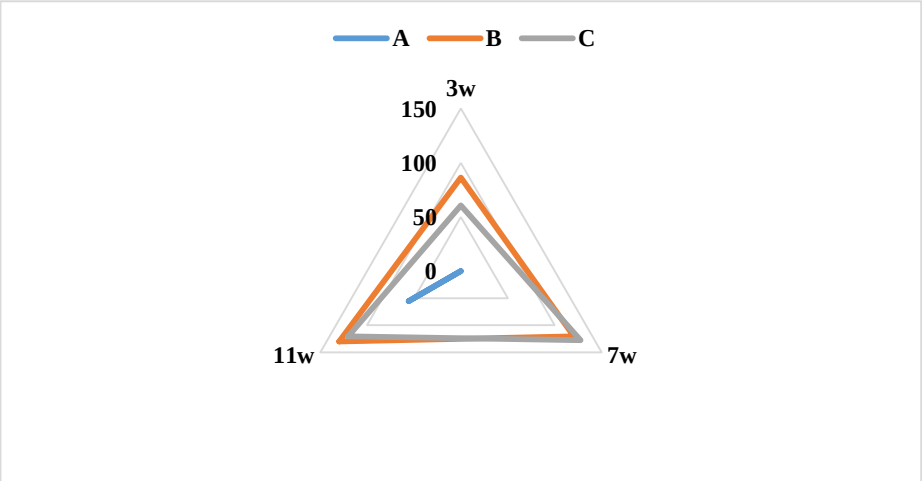

Figure 4. Average gray value of CGRP staining in new bone tissue

The CGRP numerical analysis of the regenerated skeletal healing tissue in the object area is shown in Figure 4 (Table 2). The data analysis shows that the expression of CGRP in the regenerated bone healing tissue increases with time. The difference was statistically significant ($F=94.292$, $P<0.000$). Multiple comparisons showed that group A (only bone tissue group) performed better than 3w and 7w at 11w; in group B (capillary promoted bone healing) Groups) and group C (sensory nerve bundles promoted bone healing group), when the performance of 7w was higher than 3w, there was no difference in the expression of 11w and 7w. The performance data of CGRP in the regenerated bone healing tissue between the experimental groups was very different ($F=414.124$, $P<0.000$). From each time point analysis, at different time points, the performance data values of CGRP in the regenerated bone healing tissues of each group varied greatly. The data values of F have the following 242.190, 210.787, 60.066, all $P<0.000$. Time points and nerves promote bone healing with a synergistic data function ($F=16.475$, $P<0.000$). For all the different time points, more LSD methods were used between the experimental groups. At 3w, group B (Capillaries promote bone healing) better than group A (only bone tissue group) and group C (sensory nerve bundle promote bone healing group), while group C is better than group A; at 7w and 11w, Group B and group C were better than group A, and there was no significant difference between group B and group A.

5. Conclusion

(1) The important point of nerves has an unusual role in the bone healing process of bone tissue.

The experiment that nerves promote bone healing can be used for the internal structure of the nerve tissue of bone tissue. The nerve promotes bone healing. The experiment or the combination of sensory nerve and motor nerve causes the bone to heal the bone tissue mechanism to promote bone healing, but the simple insertion into the motor nerve has no obvious effect. The sensory nerves have a significant skeletal healing effect on the bone tissue. A simple vascular bundle can achieve the same effect of promoting bone healing as the experiment in which nerves promote bone healing. The recovery of bone damage in this experiment was independent of time. Early rapid capillary vascularization is an important and necessary point to influence the organization of bone tissue.

(2) In the process of restoring bone damage in large bone tissue, only capillary vascularization and neurochemical can be done simultaneously. and normal organisms can be matched with the theory of tissue organ structure. The important point of nerves has an unusual role in bone development and recovery. The nervous system has the necessary substances and adjustment effects on the site of action and bone tissue. Neurological diseases often cause bone atrophy in better aspects. The special neuronal substances and nerve growth factors that diffuse at the last branch of the nerve have an unusual role in bone healing. Peripheral nerve fibers are regenerative, and clinical ganglion adaptation can restore neural function to varying degrees. (3) The influence of the nervous system on bone formation is complex. Skeletal healing accelerated in the brain injury group, bone healing slowed in the spinal cord injury group, and bone healing accelerated in the peripheral nerve injury group. After the sensory nerve bundle causes the bone to heal the bone tissue, the proximal end of the nerve bundle sends out the branches through undamaged or undegenerated neurons. The regenerated nerve fibers are combined with the action sites, and the special neurological substances are involved in bone growth metabolism through transport in the middle. Special neuronal substances that are diffused by sensory neurons promote capillary growth and capillary vascularization, thereby accelerating bone recovery. This important point of nerve plays an important role in promoting ossification in tissue engineering. Bone tissue is a unique tissue that does not have the ability to regenerate scars. In most cases, the recovery of soft tissue damage is the formation of scar tissue, and the bone tissue can complete the recovery of the injury by itself. Self-healing of bone tissue is a very complex process that involves regenerating bone formation, capillary regeneration, and nerve regeneration. Nerve regeneration is an important and important point that affects the re-generation of capillary formation in healing tissues.

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Data Availability

Data sharing is not applicable to this article as no new data were created or analysed in this study.

Conflict of Interest

The author states that this article has no conflict of interest.

References

[1] Dooley, J., Robacki, J., Jenkins, S., Wrisley, R., & Lee, P. C. (2016)"Development of Microlayer Blown Film Technology by Combining Film Die and Layer Multiplication Concepts", Polymer Engineering & Science, 56(5), pp.598-604.

[2] Wang, X., Jin, J., & Lei, D. (2017)" Review:State-of-The-Art of Stamping-Forging Process With Sheet Metal Blank", Journal of Harbin Institute of Technology, 24(3), pp.1-16.

[3] S.M, & Xiong. (2016)"Correlation Between Porosity and Fracture Mechanism in High Pressure Die Casting of Am60b Alloy", Journal of Materials Science & Technology, 32(1), pp.54-61.

[4] Stürzer, D., & Arnold, A. (2015)"Spectral Analysis and Long-time Behaviour of A Fokker-Planck Equation With A Non-Local Perturbation", Mathematics, 25(1), pp.53-89.

[5] Kohls, H., Anderson, M., Dickerhoff, J., Weisz, K., Córdova, A., & Berglund, P., et al. (2015)"Selective Access to All Four Diastereomers of A 1,3 - Amino Alcohol by Combination of Aketo Reductase - and An Amine Transaminase - Catalysed Reaction.", Advanced Synthesis & Catalysis,357(8), pp.1808-1814.

[6] Sherwood, P. W. (2015)"Neue Mehrbasische Säuren Verbreitern Die Rohstoffgrundlage Für Alkydharze", European Journal of Lipid Science & Technology, 63(11), pp.1049-1051.

[7] Meinert, D. I. H., Senger, D. I. T., Wiebking, D. I. N., & Diegelmann, D. I. C. (2015)"The Plug-In Hybrid Technology of The New Bmw x5 Edrive", Mtz Worldwide, 76(5), pp.4-9.

[8] Sherwood, P. W. (2015)"Neue Polyole Für Die Anstrichmittel - Industrie", European Journal of Lipid Science & Technology, 62(4), pp.335-337.

[9] Kaufmann, H. P., Lüßling, T., & Karabatur, A. (2015)" Über Den Nachweis Von Rüböl in Olivenöl Und Die Quantitative Papier - Chromatographie Des Rüböls", European Journal of Lipid Science & Technology, 58(11), pp.985-991.

[10] Wang, M. O., Vorwald, C. E., Dreher, M. L., Mott, E. J., Cheng, M. H., & Cinar, A., et al. (2015)"Evaluating 3D-Printed Biomaterials As Scaffolds for Vascularized Bone Tissue Engineering", Advanced Materials, 27(1), pp.138-44.

[11] Griffin, K. S., Davis, K. M., Mckinley, T. O., Anglen, J. O., Tien-Min G. Chu, & Boerckel, J. D., et al. (2015)"Evolution of Bone Grafting: Bone Grafts and Tissue Engineering Strategies for Vascularized Bone Regeneration", Clinical Reviews in Bone & Mineral Metabolism, 13(4), pp. 232-244.

[12] Roux, B. M., Cheng, M. H., & Brey, E. M. (2015)"Engineering Clinically Relevant Volumes of Vascularized Bone", Journal of Cellular & Molecular Medicine, 19(5), pp.903-914.

[13] Nakano, K., Murata, K., Omokawa, S., Akahane, M., Shimizu, T., & Kawamura, K., et al. (2016)"Promotion of Osteogenesis and Angiogenesis in Vascularized Tissue-Engineered Bone Using Osteogenic Matrix Cell Sheets", Plastic & Reconstructive Surgery, 137(5), pp.1476-1484.

[14] Eweida, A., Fathi, I., Eltawila, A. M., Elsherif, A. M., Elkerm, Y., & Harhaus, L., et al. (2017)"Pattern of Bone Generation After Irradiation in Vascularized Tissue Engineered Constructs", Journal of Reconstructive Microsurgery, 34(02), pp.130-137.

[15] Rao, R. R., Vigen, M. L., Peterson, A. W., Caldwell, D. J., Putnam, A. J., & Stegemann, J. P. (2015)"Dual-Phase Osteogenic and Vasculogenic Engineered Tissue for Bone Formation", Tissue Eng Part A, 21(3-4), pp.530-540.

[16] Blache, U., Metzger, S., Vallmajomartin, Q., Martin, I., Djonov, V., & Ehrbar, M. (2016)"Dual Role of Mesenchymal Stem Cells Allows for Microvascularized Bone Tissue-Like Environments in Peg Hydrogels", Advanced Healthcare Materials, 5(4), pp.489-498.

[17] Ma, D., Ren, L., Cao, Z., Li, J., Cao, J., & Tian, W., et al. (2016)"Prefabrication of Axially Vascularized Bone By Combining β-Tricalciumphosphate, Arteriovenous Loop, and Cell Sheet Technique", Tissue Engineering & Regenerative Medicine, 13(5), pp.579-584.

[18] Liu, Y., Chan, J. K., & Teoh, S. H. (2015)"Review of Vascularised Bone Tissue-Engineering Strategies With A Focus on Co-Culture Systems", Journal of Tissue Engineering & Regenerative Medicine, 9(2), pp.85-105.

[19] Patrick, N., & Payatakes, A. (2017)"Vascularized Spare Parts Reconstruction of Hand Gunshot Injury", The Journal of Hand Surgery (Asian-Pacific Volume), 22(03), pp.391-395.

[20] Eweida, A., Fathi, I., Eltawila, A. M., Elsherif, A. M., Elkerm, Y., & Harhaus, L., et al. (2017)"Pattern of Bone Generation After Irradiation in Vascularized Tissue Engineered Constructs", Journal of Reconstructive Microsurgery, 34(02), pp.130-137.