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Research Paper

Drynaria Fortunei: Another Leap in Herbal Approach to Periodontics

Medical Science

KEYWORDS : Drynaria fortunei, Gu-Shui-Bu, Osteogenesis

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ABSTRACT

In ancient times, throughout the world, humans used plants as food and medicine. In Europe, chemistry developed rapidly after the influence of Paracelsus. Active principles were isolated from plants, and drugs were prepared in the salt form to be used as medication. In China, several drugs isolated from plants have been prepared in the salt form in recent years, but herbal medication, developed in the ancient tradition, continued to be widely used in Chinese populations. Chinese biomedical scientists are now developing a new approach to medicine by combining traditional Chinese medicine and western biomedical science. Despite encouraging preliminary clinical reports about clinical improvement with the use of traditional Chinese medicines, Gu-Sui-Bu, basic science and clinical mechanism responsible for this effect has not yet been identified.

INTRODUCTION:

In ancient times, throughout the world, humans used plants as food and medicine. In Europe, chemistry developed rapidly after the influence of Paracelsus. Active principles were isolated from plants, and drugs were prepared in the salt form to be used as medication. In China, several drugs isolated from plants have been prepared in the salt form in recent years, but herbal medication, developed in the ancient tradition, continued to be widely used in Chinese populations. Traditional Chinese medicine is a treasure house, which has shown beneficial clinical effects. Reports of efficacy of traditional Chinese medicine are increasing in numbers. The increasing popularity of traditional Chinese medicine and/or natural products has also produced fear about their toxicity and uncertainty about their ingredients. In the Western world, medicinal herbs are becoming increasingly popular and important in the public and scientific communities, but they have met with skepticism from much of the medical community. Until the safety, efficacy, mechanism of action, and toxicity determination as well as clinical trials have been scientifically evaluated, many western health care experts are hesitant to embrace their use.[1]

Drynaria fortunei (Kunze) J. Sm (Polypodiaceae), a large epiphytic or petrophilous fern, is a source of traditional Chinese medicine commonly known as "Gu-Sui-Bu". The plant grows on tree trunks, rocks, and occasionally on brick walls. The species has been widely distributed in Taiwan, China, Vietnam, Thailand, and Laos (Anonymous 1994). The medicine "Gu-Sui-Bu" has been commonly used in the treatment of bone injuries. It has been shown to be effective for the treatment of inflammation, hyperlipemia, and arteriosclerosis (Anonymous 2005). In studies carried out in vitro, "Gu-Sui-Bu" was effective in antiresorptive action in bone cells and prevented osteoporosis (Jeong et al. 2005). Results from a recent study showed that "Gu-Sui-Bu"

extract taken orally increased bone density (Wong and Rabie 2006). "Gu-Sui-Bu" has also been shown to possess the therapeutic effects on bone healing (Ma et al. 1996; Lin et al. 2002; Chang et al. 2003; Sun et al. 2004).[2]

The traditional Chinese medicines, Gu-Sui-Bu [Drynaria fortunei (kunze) J.Sm] was commonly used to manage disorders of orthopedics and had been claimed to have therapeutic effects on bone healing. Specifically, through tissue culture and isotope tracing, it was found that Gu-Sui-Bu injection significantly promoted calcification of the cultivated chick embryo bone primordium, increased ALP activity in the cultivated tissue, and accelerated synthesis of proteoglycan .Later, Liu et al. has shown that Gu-Sui-Bu has an antioxidant effect on rat osteoblasts from hydrogen peroxide-induced death and may promote bone recovery under similar pathologic conditions .Gu-Sui –Bu should be intensively studied for its possible use in bone diseases.[3]

Fig 1: The fern Drynaria Fortunei

Fig 2: Leaves of the fern

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USES OF DRYNARIA FORTUNEI IN PERIODONTICS:

1.Antimicrobial activity of D.fortunei extract:

The dried and powered roots (1.2 kg) of D. fortunei were extracted by repeated refluxing with methanol (MeOH) (2×6 L) for 4 h at 80C. The combined MeOH extract (12 L) was clarified by filtration and evaporated to obtain dark brown syrup (210 g). The MeOH extract was suspended in water (H2O) and partitioned with chloroform (CHCl3), ethyl acetate (EtOAc), and n-butanol (n-BuOH) successively. The organic solvent extracts were dried in vacuum at 45 C to yield the CHCl3 soluble fraction (0.23 g), EtOAc soluble fraction (8.94 g) and n-BuOH soluble fraction (22.47 g).

CHCl3 and n-BuOH fractions of D. fortunei show the strongest antimicrobial activity against all the oral bacteria (MICs, 0.0078 to 0.3125 mg/ml; MBCs, 0.019 to 0.625 mg/ml), except S. criceti, A. actinomycetemcomitans, and F. nucleatum (MICs/MBCs values; 1.25 to 5/1.25 to 10 mg/ml).[4]

Fig 3: Drynaria root extract

Fig 4: In powder form

Fig 5: In liquid form

2.Synergistic effects of D.fortunei with antibiotics:

The use of antimicrobial agents such as ampicillin, chlorhexidine, erythromycin, penicillin, tetracycline, and vancomycin to suppress cariogenic bacteria, and thereby to inhibit the development of caries, seems to be a rational approach and the World Health Organization (WHO) has recommended and encouraged the use of chewing sticks as an effective tool for oral hygiene. Recently, many researchers reported that many plant extracts or derivatives have been incorporated into commercial toothpastes and mouthwashes to treat oral diseases related to caries or periodontal diseases . Some of the polyphenols isolated from plants exhibit anticaries activity either due to growth inhibition against mutans streptococci or due to the inhibition of glucosyltransferases . D. fortunei contains several flavonoids of which biological activities are reported as antinephrotoxicity, kidney primary epithelial tubular cell regeneration, and inhibition of gentamicin ototoxicity and bone resorption . Previously, researchers reported that several essential oils from plants had antibacterial activity against oral bacteria. The oolong tea polyphenols possess a strong antiglucosyltransferase activity and inhibit experimental dental caries in species pathogen-free rats infected with mutans streptococci . Cacao beans, which form the main constituent of chocolate, contain some polyphenols which exhibit antiglucosyl transferase activity .The D. fortunei is composed of many flavonoids then, thus it may perhaps indicate strong antibacterial activity against oral bacteria.[5]

3. Improvising bone properties for regeneration as researched in rat dental pulp stem cells:

Jeong et al also demonstrated that Drynaria fortunei is capable of promoting osteoblastic differentiation and mineralization in osteoblastic MC3T3-E1 cells through the regulation of bone morphogenetic protein-2, alkaline phosphatase (ALP), type I collagen and collagenase-1, indicating that it has anabolic effects on bone (7). Shu et al reported that total flavonoid from Drynaria fortunei promotes the osteogenic differentiation of bone mesenchymal stem cells.

Tissue engineering utilizing DPSCs has the potential for dental tissue and tooth regeneration, and to stimulate bone tissue growth and repair. As a first step towards the goal of successful development of tissue engineering in experimental and clinical dentistry, we attempted to explore the effect of total flavonoids from Drynaria fortunei on proliferation and osteogenic differentiation in rat DPSCs.

Dental pulp is loose connective tissue with high vascularization, and is composed of different cells, such as dental pulp fibroblasts, odontoblasts and undifferentiated mesenchymal cells. It has recently been recognized that the undifferentiated mesenchymal cells in dental pulp tissue are DPSCs, which make up a small fraction of dental pulp tissue. total flavonoids from Drynaria fortunei are capable of promoting DPSC proliferation and do not cause cytotoxicity to DPSCs. Treatment of DPSCs at concentrations of 0.01, 0.05 and 0.1 g/l total flavonoids from Drynaria fortunei does not change cell morphology or cell viability.

Drynaria fortunei is capable of enhancing DPSC osteogenic differentiation and mineralization, possibly through the Runx-2-mediated induction of ALP, osteocalcin and collagen gene expression, and thus that one of the major reasons explaining total flavonoid from Drynaria fortunei promotion of osteogenic differentiation in DPSCs was its effect on regulation of expression of these osteogenic genes. The study carried out by Hung et al also showed that total flavonoid from Drynaria fortunei promoted IGF-1 expression, and then indirectly promoted the expression of various bone differentiation-related genes, such as BMP-2, BMP-6, ALP, OPN and OCN mRNA expression.[6]

CONCLUSION:

Chinese biomedical scientists are now developing a new approach to medicine by combining traditional Chinese medicine and western biomedical science. Despite encouraging preliminary clinical reports about clinical improvement with the use of traditional Chinese medicines, Gu-Sui-Bu, basic science and clinical mechanism responsible for this effect has not yet been identified. One of the major effects of Gu-Sui-Bu on the bone cells is probably mediated by its effect on the osteclasts attachment. continued and advanced study on the alterations in gene expression of bone cells by Chinese medicines will provide a basis for understanding the observed bone cell responses to various pharmacological interventions.[7]

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