

Development of Clinical Visual Physiology in China during Past Fifty Years

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The studies of clinical visual physiology (CVP) were initiated in 1950s in China. Clinical visual physiology, as an essential method to evaluate the vision function, provides important information for assessment and treatment of certain ocular diseases in retinal and optic pathway. It has become an important part in the development of ophthalmology in China.

Stage of Development

In the 1950s, Drs Yaozhen Chen (Eugene Chan, 1899–1986) and Wenshu Mao (Winifred Mao, 1910–1988) proposed to bolster a clinical visual physiology lab in the Department of Ophthalmology, Zhongshan Medical College. This idea was based on the advanced development pattern established by the Wilmer Ophthalmological Institute (Wilmer Eye Institute), which integrates teaching, clinical service, and fundamental research in application. Between 1929 and 1934, Yaozhen Chen conducted some research with visual physiology in Wilmar Ophthalmological Institute. He believed that further studying in visual physiology must play an important role in eye research.

Cultivation of visual scientists

In 1956, Wenbing Zhou, a graduate student of Chen, did his research project in visual field study. Almost in the same time, Yuanxiu Lao in Peking Union Medical College published a book ‘Clinical Visual Field’, 1957.

In 1959, Lezheng Wu did the research project in ‘dark adaptation’, also guided by Chen. As a pilot, Lezheng Wu started the clinical visual electrophysiology research in China in 1961 and founded the clinical visual physiology lab in the Department of Ophthalmology, Zhongshan Medical College, in 1962.

Beside the research and application in Guangzhou, the researchers in other cities also took the initiative in performing tests in clinical visual physiology. As one of the pioneer professionals, Jing’e Zhang was in charge of clinical ocular physiology in Tongren Hospital, Beijing. Some CVP work also was done in Tianjin Eye Hospital, and in Shanghai Second Medical College in the 1960s.

Construction of inter-disciplinary subjects

In 1965, Dezheng Wu, graduated in biophysics, participated the visual physiology research group, that, innovatively proposed by Chen, admitted people with multi-disciplinary knowledge into the research team. Through this cultivating mode, the professionals not only benefitted from solid academic knowledge but also accepted multi-disciplinary challenges to promote the development in clinical visual physiology. Since then, several generations of graduates who had multiple knowledge, such as in biology, physics, biomechanics, electronics, computer science, general physiology or otorhinolaryngology,

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were trained with clinical visual physiology. The unique training and combination programs drove profound progress and achieved new academic heights in the clinical visual physiology field. In 1993, Dezheng Wu did the exchange program with University College of London, Institute of Ophthalmology, in the UK and paid more attention to motion perception.

Yumin Liu (1921–2005), a researcher in the Physiological Institute of Chinese Academy of Science, was in charge of a laboratory for sense organs and provided advanced training for clinicians, which intensified the collaboration between basic and clinical research, and enhanced the application of fundamental studies into clinical visual physiology.

Introduction of advanced equipment

In early stages, the equipments in the laboratory in Zhongshan Medical College, Guangzhou, had been purchased abroad. The instruments included a Hartinger adaptator (Jena Zeiss, East Germany), Elema-Schöander electroretinograph (Sweden), and San-Ei electrophysiological device (Japan), and so on. Some domestic manufacturers in Shanghai and Chongqing produced visual electrophysiological device in the 1960s for the first time.

Publication

Since the 1960s, a number of papers related to clinical visual physiology have been published in the Chinese Journal of Ophthalmology, Chinese Medical Journal, *Acta Physiologica Sinica*, etc. This involved the research of physiological function in vision, diagnosis and assessment of prognosis in the treatment of ocular diseases, and so on.

Stage of Reform

Unfortunately, during the period of 1966~1976, the researches regarding clinical visual physiology underwent severe disaster and were almost plunged into deadlock. Experimental equipments were laid aside or damaged. The research team was forced to disassemble. All scientific works in most universities, hospitals and institutes were stagnated in a catastrophic retroversion.

In 1978, the study in clinical visual physiology was significantly revitalized. A laboratory of visual

electrophysiology was established by Lezheng Wu in the Department of Ophthalmology (Director: Zheng Hu), Peking Union Hospital. In addition, the study in visual electrophysiology has been developed by universities and hospitals in more cities in China.

Exchange and training abroad

In the late 1970s, Chen and Mao actively recommended young doctors to participate in exchange and training programs abroad. From the late 1970s to 1980s, many qualified clinicians from Peking Union Medical College, Beijing Medical College and Zhongshan Medical College, were sent to world famous universities and institutes for advanced training or postgraduate study in visual physiology. They studied in Stanford University, John Hopkins University (including Wilmer Eye Institute), National Eye Institute/National Institutes of Health in USA; University College of London, Institute of Ophthalmology, in UK; University of Essen in Germany; subsequently some were also dispatched to Japan, Sweden, Israel, Australia, etc. This provided an opportunity for researchers and clinicians in China to obtain the latest academic knowledge, receive professional skill-related training, and broaden their horizons. More importantly, it made fast substantive progress in clinical visual physiology possible in China.

Revitalizing academic exchange

Since 1987, the ‘National Symposium on visual electrophysiology’ has been regularly held in China. It evolved into the ‘National Symposium on clinical visual physiology’ in 1997. The participants discussed various investigations related to subjective and objective visual functional evaluations in visual psychophysiology and visual electrophysiology in the conference, providing an excellent communication platform for clinicians, research scientists and postgraduates who were engaged in clinical visual physiology. They shared their experiences and made the newest progress and achievement in their research work.

Constructing the academic section in the society

In 1987, the Visual Electrophysiology Section was established and affiliated to Society of Ophthalmology, Chinese Medical Association. After a 10-year

Table List of National Symposiums on Clinical Visual Physiology in China(1987–2011)

Session	Conference	Date	Venue	Organizer
1 st	National Symposium on Clinical Visual Electrophysiology	1987	Nantong, Jiangsu	Lezheng Wu
2 nd	National Symposium on Clinical Visual Electrophysiology	1988	Leshan, Sichuan	Guihui Zhang, Yaping Deng
3 rd	National Symposium on Clinical Visual Electrophysiology	1991	Xi'an, Shaanxi	Xuan Wang
4 th	National Symposium on Clinical Visual Electrophysiology	1992	Beijing	Xiaoxin Li
5 th	National Symposium on Clinical Visual Electrophysiology (Satellite Meeting of Asia-Pacific Visual Science Conference)	1994	Guangzhou, Guangdong	Lezheng Wu
6 th	National Symposium on Clinical Visual Physiology	1997	Qingdao, Shandong	Cong Hu
7 th	National Symposium on Clinical Visual Physiology (Satellite Meeting of 12 th Afro-Asian Congress of Ophthalmology)	2000	Guangzhou, Guangdong	Dezheng Wu
8 th	National Symposium on Clinical Visual Physiology	2002	Harbin, Heilongjiang	Wanzhang Gu, Yuguo Wang
9 th	National Symposium on Clinical Visual Physiology	2004	Chengdu, Sichuan	Junguo Duan
10 th	The 10 th Chinese Visual Physiology Conference	2006	Chongqing	Zhengqin Yin
11 th	The 11 th Chinese Visual Physiology Conference	2009	Shanghai	Ling Wang
12 th	The 12 th Chinese Visual Physiology Conference	2011	Wenzhou, Zhejiang	Xiaolin Liu

development in vision research, the section has been expanded into “Visual Physiology Section.” It covers all disciplines of the visual physiological field and diversifying academic exchange contents. The section was led by Lezheng Wu in 1987–2005, and followed by Zhengjin Yin.

Stage of Striding Forward

The subject construction makes rapid strides in academic achievement of paper and book publications, instrument production, and international exchange.

Paper publication

During the past 30 years, from 1979 to 2008, 2094 papers related to clinical visual electrophysiology were published and indexed in the Chinese Biomedical Literature Database. Among them, 737 papers have been reported between 2004 and 2008, a 48-times increase compared with the 15 papers published from 1979 to 1983. In addition, the authors of these 737 papers came from 30 regions in China, 10-times broader compared to the three regions from 1979 to 1983. This indicates clinical visual physiology was rapidly developing in China during that period. Over 100 papers related to visual electrophysiology were published in the journals sponsored by multiple provinces and cities such as Guangdong, Beijing, Shanghai, Jiangsu, Shandong,

Sichuan, and Henan. The amounts of published papers indexed by the Science Citation Index have been doubled in the last several years.

Other than the regular visual electrophysiological testing, the functional analysis in ERG (Intensity-Response Function), color stimuli in evoking EOG, and VEP captivated much attention from the researchers and experienced a valuable progress. The multifocal visual electrophysiology has been applied in main hospitals in the cities like Beijing, Shanghai, Guangzhou, etc.

In the clinical visual psychophysics Yuanxiu Lao, as a leader in visual field research, made vital contributions. She joined the project entitled ‘Basic and clinical research on hormone secreting pituitary adenoma’, which won the first prize of China National Science and Technology Progress Award in 1992. The clinical visual psychophysics also extended into micro visual acuity, micro visual field, contrast sensitivity, motion perception, and so on. The ‘Color vision plate’ was compiled in the cities/province of Nanjing, Gansu, Shanghai, Shenyang, and Guangzhou. It was revealing a common focus on color vision in China.

With the graduate training program applied in universities, the discipline construction of visual physiology in China has been strengthened. In particular, it has made considerable achievements in the visual evaluation in amblyopia, functional studying in

macular diseases, and so on.

Books

A series of visual physiology books have been published since 1980s, such as: Electroretinogram (Wu L and Wu D, Science Press, 1989); Clinical Visual Electrophysiology (Wang X, Guo SY, Shanxi Science and Technology Press, 1993); Visual Electrophysiology (Wang FB, Inner Mongolia Science and Technology Press, 1997); Clinical Visual Electrophysiology (Wu L and Wu D, Beijing Science and Technology Press, 1999); Principle and Practice of Visual Electrophysiology (Li HS, Shanghai Science Popularization Press, 2002); Clinical Multifocal Visual Electrophysiology (Wu L, Beijing Science and Technology Press, 2004); Clinical Computerized Visual Field (Wu D, Beijing Science and Technology Press, 2004); Practical Visual Electrophysiology (Wang FB, Heilongjiang People's Press, 2005); Atlas of Testing and Clinical Application for ROLAND Electrophysiological Instrument (Wu D, Beijing Science and Technology Press, 2006); and Examination Methods and Application of Clinical Visual Electrophysiology (Wu D, Chinese Medical Electronic Audio Visual Press, Beijing, 2007), etc.

All these academic books significantly contributed to the uniform principle and practice of clinical visual electrophysiology, the standardization of procedures, and profound investigation upon the disease progression, pathogenesis, and clinical treatment of retina and optic nerve-related eye diseases. The book named Clinical Multifocal Visual Electrophysiology was honorably supported by State Fund - NFAPST (National Fund for Academic Publication of Science and Technology). In addition, the system book: Chinese Ophthalmology summarized the latest progress in clinical visual physiology in its first and second editions.

Academic exchange

To date, twelve sessions of the "National Conference on Visual Physiology" have been successfully held in China since 1987. It displayed an excellent platform for academic exchange nationwide and greatly strengthened international collaborations. Specialists from seven countries have attended the conferences.

In 1990, the 28th International Symposium of Clinical Electrophysiology on Vision was held in Guangzhou, China. Over 148 ophthalmologists and visual scientists from 16 countries attended the conference and discussed passionately during the meeting. Lezheng Wu, the Chairman of the Symposium, was selected as a committee member of International Society of Clinical Electrophysiology on Vision (ISCEV). He was the first Chinese ophthalmologist board member in the ISCEV committee and administrated academic affairs of Asia and Australia, indicating that the Chinese academy in this field was recognized by the international scientific community.

In 1994, the Asia-Pacific Visual Science Conference was successfully held in China. In 2000, as the Satellite Meeting of 12th Afro-Asian Congress of Ophthalmology, the 7th Symposium of Clinical Visual Physiology was also held in Guangzhou, China.

Instrument production

The instruments for visual electro-physiology and automatic perimeter are now made by manufactories in the cities of Chongqing, Shanghai, Beijing, Hangzhou, Jinan, Suzhou and Zhongshan in China. However, these factories have been unable to develop large scale instruments or continue to launch products in some factories. Nevertheless, the domestic instruments have promoted the clinical practice in visual physiology.

Summary

In the past 50 years, China has experienced a valuable development stage of clinical visual physiology and made substantial progresses in the aspects. It not only contributes to ophthalmology development, but also cultivates the precious visual physiology scientist and researcher groups in China and will advance Chinese ophthalmology toward a glorious future.

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