



Full Length Article

The history of bone densitometry

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ABSTRACT

Bone densitometry (dual energy x-ray absorptiometry-DXA) is a vital medical tool needed for the diagnosis of osteoporosis in non-fractured patients; predicting future fracture risk; and monitoring bone mineral density (BMD) in untreated or treated patients. The history of the pivotal international society involved in the science and clinical interpretation of DXA, the International Society for Clinical Densitometry (ISCD) is defined in this manuscript. Since DXA and Osteoporosis management are intimately linked, the ISCD has over the years developed strong bonds with both the National Osteoporosis Foundation (NOF) and the International Osteoporosis Foundation (IOF). The positive impact that ISCD has led in the proper performance and clinical interpretation of bone mass measurements has been enormous worldwide.

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1. Introduction

The technology and the science of 2 dimensional measurement of bone mass was pioneered by 2 men of genius and vision: Dr. Richard Cameron and Dr. Richard Mazzeo [1–2].

The genius of their engineering fostered the use of the concept of dual energy x-ray delivery methods to better discriminate between soft tissues from bone and thereby enhance the direct bone edge measurement. The physics of dual energy/(as opposed to single energy photon sources) in principle is where 2 different energy sources (30–50-KeV and >70 KeV) allows greater discrimination soft tissue and enhanced bone edge detection and was a major advancement in the accuracy as well as precision of dual energy x-ray absorptiometry (DXA). This authors charge by the editors of BONE is to provide a narrative of the evolution of the clinical interpretation of bone densitometry since we recognized, from the beginning that the information provided on the bone densitometry computer printout had little practical application for guiding physician management decisions without some form of clinical wording to help interpret the printed numbers with clinical meaning. As the appointed Chairman of the ISCD steering committee for the first the 4 years and then the elected Founding President for next 3 years it was my responsibility first to choose an effective steering committee and then later committee members to develop and then apply a “clinical” profile to the computerized dual energy x-ray absorptiometry (DXA) printout in order to bring clinical meaning to the raw numbers whether the numbers are the baseline measurement or the serial measurement. It is important to stress from the beginning that

many peers and mentors provided insight, guidance, and very hard work in accomplishing the task of making the DXA computer page (the automatic printout of the standard DXA report) clinically meaningful and useful. Without their combined faithful efforts none of that which is written here would be possible.

2. The concept

On a boat ride from Hong Kong to McCaw, China in 1990, during the 1st International Osteoporosis Symposium headed by Dr. Claus Christiansen of Copenhagen, Denmark, Mr. Perry Owen of Proctor and Gamble Pharmaceuticals introduced the idea of developing a society for excellence in the performance and interpretation of bone densitometry. Mr. Owen supported the funding of a steering committee to develop strategies and plans for the construction of a professional society-the society of clinical densitometry (SCD). A steering committee was formed of the following members (Table 1).

The committee met for 2 days in Chicago, Ill (USA) in 1993 and formed principles of guidelines for excellence in bone densitometry performance and interpretation. After the initial steering committee met, the group worked diligently to format the first international manuscript that was as evidence-based as was available at the time. Soon after, Mr. Owen and the author went to the annual board meeting of The National Osteoporosis Foundation (NOF) in Washington, D.C. to present the concept of the society and its mission. Our mission was to train and certify DXA technicians who perform bone densitometry and the physicians who interpret them, and, to insure good and consistent accuracy and precision of the studies and properly interpret the data clinically. It had become clear that in order for DXA results and management decisions following testing to be trusted there needed to be the formation

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Table 1

The original members of the ISCD steering committee.

Dr. Sydney L. Bonnick (General Internal Medicine), Denton, Texas
Dr. Maria Greenwald (Rheumatologist), Palm Springs, California
Dr. Cliff Rosen (Endocrinologist), Bangor, Maine
Dr. David Sartoris (Radiologist), San Diego, Ca
Dr. Al Moffett (Gynecologist) Ft Meyers, Fla
Dr. Paul D. Miller (Nephrologist) (Chair)
Mr. Perry Owen (Advisor)

of a society dedicated to the cause of quality measurements and clinical interpretation. The “numbers” printed out of DXA computer reports have little meaning without broad clinical input.

The NOF acceptance of the SCD (Society for Clinical Densitometry) before it became ISCD (International Society for Clinical Densitometry) was cordial but cautious since societies had to compete for financial support from similar sources. The point stressed to the NOF by this author that if our new society “did its job right”, the “pot would grow.” In time, that prediction would turn out to be true. Both societies have prevailed, and have worked cooperatively to fulfill each other missions.

Shortly after this meeting 3 key individuals from ISCD (Miller, Bonnick and Rosen) met again with key leaders of the NOF (Drs. Robert Lindsay, Larry Riggs, and Conrad Johnston) to gain support for the development of a “white” paper on the clinical use of bone densitometry. In 1995 the first ISCD paper on guidelines for the clinical interpretation of bone densitometry was published by Miller, PD; Bonnick SL, and Rosen CJ in *Calcified tissue International* [3–4]. Shortly after this publication an international group of metabolic bone leaders met for 2 days in Virginia to develop more in depth structure and financial support for the ISCD and wrote the second paper on the clinical use of bone densitometry [5]. This second manuscript expanded the great value that a clinical paragraph of meaningful clinical management decisions that could be made from the absolute bone mineral density or their respective standard deviation scores from a highly respected international authorities in the field of osteoporosis.

In 1996–1997 two pivotal developments occurred that led to a more structured society with a vision and purpose: the creation of the 1st bone densitometry certification courses by Drs. Ken Faulkner, Sydney Bonnick and Paul Miller where a 2 day educational lecture program was presented to physicians on bone densitometry principles of measurements and interpretation; and, the creation of the first elected board of directors with a formal democratic voting structure that was held in Charleston, SC. Shortly after this constructive meeting the first annual meeting of the SCD was held in Chantilly, Virginia in 1996 with approximately 300 attendees.

The society had been launched.

Though the societies primary mission was to apply some clinical meaning and management suggestions that could be derived from the numbers only provided in the DXA report, the society also developed as part of its membership the important role that DXA technologists play in maintaining quality control and continual performance. For one example, the ISCD taught it’s members that not only daily in vitro (phantom scanning) was important but that each densitometry facility in order to know it’s in vivo precision (and precision error) must periodically perform live human being (in vivo) precision studies. Without these in vivo quality control measures, no DXA facility can ever reliably report true and accurate serial BMD measurement results.

The first name SCD was changed to the ISCD (International Society for Clinical Densitometry) in 1997 when it was clear that there the international community, lead first by Dr. Sergio Ragi-Eis of Brazil (who in fact started the world’s first bone densitometry certification course). The Brazilian’s embraced our North American society and was instrumental behind the international expansion of ISCD, and the first a great need for international bonds of a society with a common purpose. Dr. Ragi-Eis enthusiasm lead to his creation of the 1st annual meeting of The ISCD outside North America in Rio de Janero Brazil in 2000. Dr.

David Kendler from Vancouver, BC, Canada headed the 1st position development conference in 2005 C and Dr. John Carey from Galway, Ireland spearheaded the 2nd international annual meetings in 2016 respectfully. The year and locations of each annual meeting are shown in [Table 2](#).

In its history the ISCD:

1. Started its own peer-review scientific, *The Journal of Clinical Densitometry* with the 1st Editor-in-Chief, Dr. Cliff Rosen successfully insuring the journals scientific work.
2. Created The Position Development Conferences (PDCs): an international collection of bone mineral density and osteoporosis experts who develop and grade evidence and make recommendations for specific scientific and clinical issues [6–10]. Only a few PDC publications are listed but if readers are interested in the enormous effort put forth by the ISCD and IOF in putting scholarly structure into many aspects of bone mass measurements, **PUBMED** has all of the PDC’s compiled over the years.
3. Initiated certification courses for both physicians and technologists which are CME 1 accredited and provide a specific and standardized level of excellence in the performance and interpretation of bone densitometry and its associated applications (VFA: vertebral fracture assessment; body composition; and, soon may add trabecular bone score (TBS) to its certification courses).
4. Developed cooperative scientific meetings with both The International Osteoporosis Foundation (IOF) and the National Osteoporosis Foundation (NOF).
5. Developed accreditation programs for DXA facilities to show evidence in their ability to perform accurate and precise bone densitometry applications.
6. Developed the first pediatric bone densitometry assessment programs and, along with The IOF developed the program called “Osteoporosis Essentials” which is also available through an on-line webcast based avenue.

All of the ISCD’s programs and current-future programs are available via The ISCD website: **ISCD.ORG**.

Dedicated physicians and the 1st technologist (Diane Kruger from Madison, Wisconsin) to serve as an ISCD President are shown in [Table 3](#).

The current President of ISCD (at the time of this initial draft) Dr. John Shepherd of The University of California, San Francisco will hand over the Presidency to Dr. John Carey of The University of Western

Table 2

The dates and locations for each of the ISCD annual meetings.

Year	Location
1996	Chantilly, Virginia
1997	San Diego, CA
1998	Orlando, FL
1999	New Orleans, LA
2000	Rio de Janeiro, Brazil
2001	Dallas, Texas
2002	Atlanta, GA
2003	Los Angeles, CA
2004	Miami, FL
2005	New Orleans, LA
2006	San Diego, CA
2007	Tampa, FL
2008	San Francisco, CA
2009	Orlando, FL (joint with IOF)
2010	San Antonio, TX (joint with NOF)
2011	Miami, FL
2012	Los Angeles, CA
2013	Tampa, FL (included PDC)
2014	Orlando, FL (joint with IOF)
2015	Chicago, IL
2016	Galway, Ireland
2017	Orlando, Fla (joint with NOF)

Table 3
The former presidents of ISCD.

Paul D. Miller, MD (1993–1998)
John P. Bilezikian, MD (1999–2002)
Nelson B. Watts, MD (2002–2003)
E. Michael Lewiecki, MD, FACP, FACE (2003–2005)
Steven Petak, MD, JD, FACE (2005–2006)
Neil Binkley, MD (2006–2007)
David L. Kendler, MD, FRCPC (2007–2008)
Sanford Baim, MD, FACP (2008–2009)
Andrew J. Laster, MD, FACP (2009–2010)
Didier B. Hans, PhD, PD, MBA (2010–2011)
Sarah L. Morgan, MD, RD (2011–2012)
S. Bobo Tanner, MD (2012–2013)
John T. Schousboe, MD, Ph.D. (2013–2014)
Diane Krueger, BS (2014–2015)
William D. Leslie, MD, FRCPC, MSc (2015–2016)
John Shepherd PhD (2016–2017)
John Carey MD (2017–current)
Robert Blank MD (president-elect 2018–2019)

Ireland, Galway, Ireland at the next annual meeting, April 2–23, 2017 in Orlando, Florida, USA.

In addition, the ISCD developed annual award given in names of pioneers of ISCD to members who have shown exemplary work in a specific area of ISCD in order to fulfill ISCD's mission. All of the recipients of these awards can be seen on the **ISCD website**.

Under the leadership of ISCD's Executive Director, Mr. Peter Brown and his committed administrative support at The ISCD headquarters in Hartford, Connecticut, USA, and, the former and current ISCD Presidents and their Board of Directors, and the current Editor-in-Chief of The Journal for Clinical Densitometry (Ron Hamdy MD of East Tennessee State University), the ISCD has evolved into an internationally respected organization. The utilization of DXA has grown and expanded to include many other non-BMD applications that assist in patient management.

One cannot separate out measurements of bone mass from osteoporosis management. The two are intimately connected which is why the International Society for **CLINICAL** Densitometry has been and will continue to be a vital part of the whole picture of osteoporosis patient care.

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None.

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