

Jens Ove Andreassen, 1935-2020 Father of Dental Traumatology

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Abstract

The life and professional contributions to dental traumatology of Dr. Jens Ove Andreassen are described in terms of his research, writing, teaching, and leadership.

KEYWORDS

ankylosis, auto-transplantation, dental traumatology, healing complications, replantation, root fractures, traumatic dental injuries

1 | INTRODUCTION

By the early 1960s, many major advancements had been made in medicine and dentistry. Dental traumatology, however, seemed to have been neglected. The scarcity of evidence-based data on management of traumatic dental injuries inspired a young resident, Dr. Jens Ove Andreassen, in the Department of Oral and Maxillo-Facial Surgery at the University Hospital, Copenhagen, Denmark, to devote a six decades long lifetime to do research, write, and teach in what was, at the time, an underserved area in dentistry (Figure 1).

Born in 1935 in Copenhagen, Jens Ove Andreassen grew up as most Danish children, riding their bicycles to school. So it was that in 1944, as a 9-year-old boy, he had his first encounter with dental trauma. Riding home from school one day, he had an accident and fractured his left maxillary central incisor. He was taken to a dentist who determined that Jens Ove needed both root canal treatment and repair of the fractured incisor. No doubt the dentist did his best, but the result was that Jens Ove ended up with a discolored tooth. His classmates quickly applied what they had learned in history class about the Viking King, Harald Bluetooth, and began calling him "Jens Bluetooth." Such was the beginning of his lifelong involvement in dental trauma (Figure 2).

2 | RESEARCH AND PUBLICATIONS

After completing his dental education in 1959 and military service obligation the following year, Dr. Andreassen entered private practice and also became engaged in research in the Department of Oral Surgery and Oral Pathology at the Royal Dental College, Copenhagen under the renowned Professor Jens Jørgen Pindborg. It was there, as a 28-year-old intern, that Dr. Andreassen came to recognize the influence that research has on all activities. That recognition triggered his desire to participate in research and resulted in the publication of his first scientific article with Dr. Pindborg in 1963 (A full list of Dr. Andreassen's publications can be found as a Appendix S1).

During the years in private dental practice in Copenhagen, he experienced first-hand the lack of evidence-based information about treatment of dental injuries. When in 1962 he entered his oral surgery program and became a resident in the Department of Oral and Maxillo-Facial Surgery at the University Hospital, he decided to focus his research interest on dental and maxillofacial trauma with the goal of improving trauma management (Figure 3). During his residency, he collaborated with Dr. Erik Hjørting-Hansen in publishing his first articles on dental trauma, specifically replantation and root fractures—all of them based on research and extensive reviews of the available literature.



FIGURE 1 Jens Ove Andreasen, Odont. Dr. h.c



FIGURE 2 Jens Ove Andreasen as a young boy with his mother Martha and sister Helle



FIGURE 3 Dr. Andreasen, a surgery resident in University Hospital, Copenhagen in the 1960s

Dr. Andreasen recognized early on the importance of gathering data about traumatic dental injuries. He initiated a systematic registration of dental trauma cases at the University Hospital in the

mid-1960s. For data to be valuable, it was necessary for the examination processes to be as uniform as possible. He introduced the use of film holders that could help standardize exposure angulations for more accurate comparison of radiographic images. Clinical tests were also standardized and even clinical photographs had to be taken in such a way that fair comparisons could be made. Efforts were also made to have regular control appointments for evaluation of treatment outcomes. Finally, he proposed a modification of the World Health Organization classification of dental injuries to more precisely represent each traumatic entity.

In 1963, Dr. Andreasen married Gunvor Due and they raised two daughters. One of them, Dorte and her daughter Mie, helped Dr. Andreasen for many years in organizing and conducting trauma conferences at the University of Copenhagen. The marriage with Gunvor ended in 1975. A while later he met Dr. Frances Weinstein who also had a strong interest in dental traumatology. They were married in 1982 and worked as a team on numerous trauma research projects. In 1992, the marriage ended but the collaborative team work on dental trauma continued. At the 1993 World Dental Trauma Congress in London, UK, Dr. Andreasen and Dr. Anna-Lena Hallonsten, a pediatric dentist from Jönköping, Sweden, met. With their mutual interest in dental trauma, they later married and often traveled together presenting lectures worldwide. Dr. Hallonsten was at his side through his last fatal battle with the illness that took his life.

Within the first ten years of his appointment as a Research Associate and the commencement of his oral surgery specialty training, Dr. Andreasen had published 27 scientific papers, either as sole or principal co-author. In addition to his publications with Dr. Hjørting-Hansen on replantation of avulsed teeth and root fractures, the topics of relevance to dental traumatology also included etiology and pathogenesis of traumatic dental injuries, luxation injuries, the effect of primary teeth traumatic injuries on the permanent successors, and fractures of the alveolar processes and the fate of teeth in such fractures. In addition, the first of his significant research papers into the auto-transplantation of teeth was published.

The culmination of his extensive clinical experience and research during those first 10 years was the publication in 1972 of the first edition of his textbook *Traumatic Injuries of the Teeth* (Figure 4). This was a remarkable achievement. The book consisted of 10 chapters, each concluding with a summary entitled "Essentials"—an innovation typical of his practical approach to teaching. The book, which introduced a modified classification system of dental injuries (based on the WHO classification), not only incorporated much of his research material but integrated practical methods of management. This textbook was widely acclaimed and became the recommended text in many dental schools worldwide.

In the years immediately following publication of his first textbook, Dr. Andreasen's research activities intensified further and by the beginning of 1975 he had published an additional 15 articles, 9 of which were on endodontic surgery and co-authored with Professor Jørgen Rud, a distinguished Danish oral surgeon whom Dr. Andreasen regarded as a valued mentor.

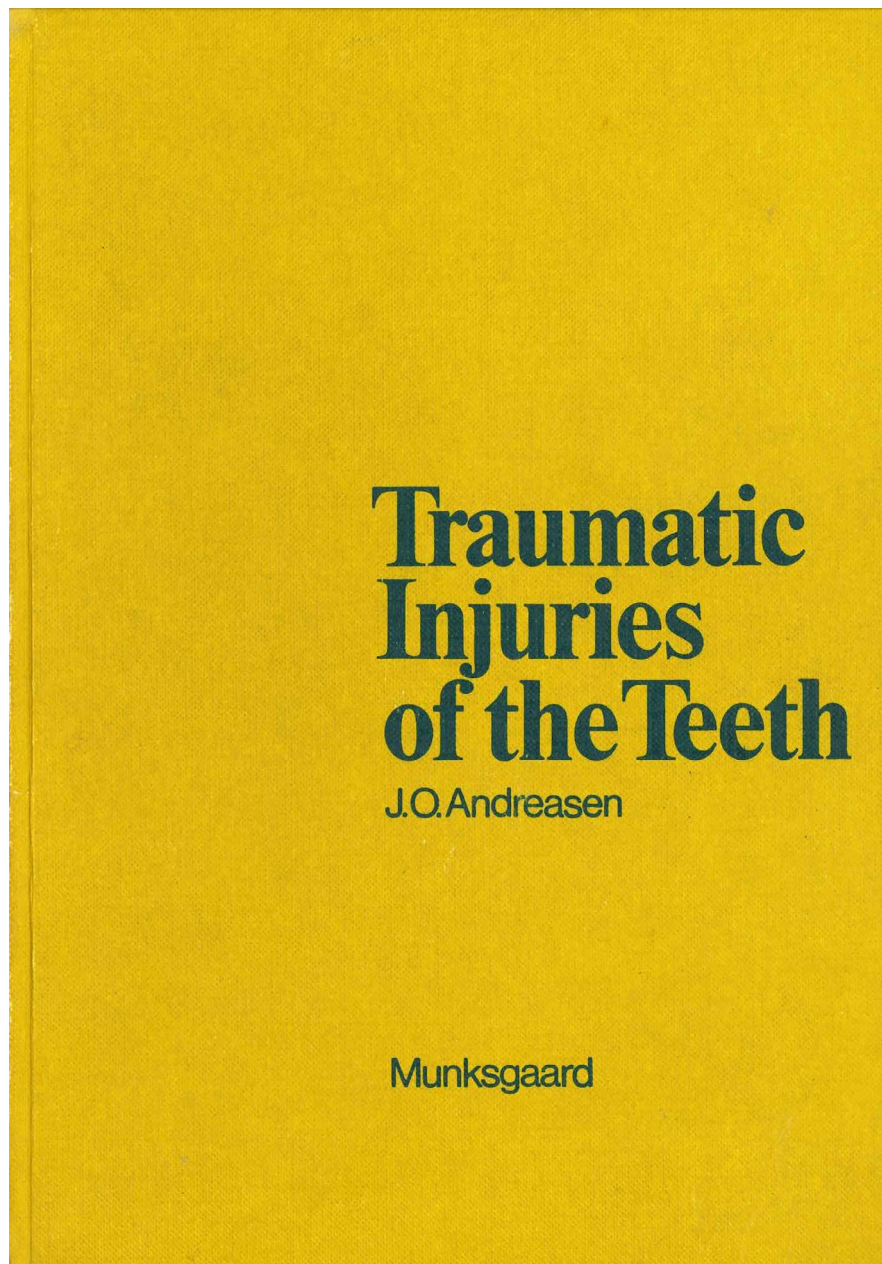


FIGURE 4 Traumatic Injuries of the Teeth, 1st edition, 1972

Dr. Andreasen had long recognized the need to study tissue reactions *in vivo* following traumatic dental injuries and such an opportunity presented itself at the Serum Institute in Copenhagen. At that time, poliomyelitis vaccine was manufactured at the Institute using cell lines from monkey kidneys. Dr. Andreasen applied for and was granted ethical approval to carry out a series of experiments in such monkeys during an eight-week period from the time of their inoculation with the polio virus to their sacrifice for vaccine production. He developed an experimental model whereby incisors of monkeys were extracted and replanted after various treatments and time frames.

After the monkeys had been sacrificed and the jaws suitably resected, fixed, embedded, sectioned and stained for histological

examination, he was able to evaluate and describe in detail the tissue responses to replantation: how the periodontal ligament and pulp healed, and how some injuries gave rise to various forms of root resorption after trauma. In a systematic way, he studied key factors of importance in clinical practice, such as sub-mucosal storage, storage media, various cleaning procedures, extra-alveolar time periods, cell damage in the periodontal ligament, limited drying or removal of the periodontal ligament, apicectomy, removal of the coagulum in the alveolus, pulp extirpation, root canal treatment, extra-alveolar root filling with calcium hydroxide, excessive occlusal trauma and splinting.

Furthermore, with his colleague Dr. Ole Schwartz, Dr. Andreasen investigated cryopreservation before replantation of mature teeth,

and in collaboration with Dr. Lars Kristerson from Sweden he also evaluated different types of auto-transplanted connective tissues as potential periodontal ligament substitutes. Of significance in pediatric dentistry was his investigation of the effect of primary tooth intrusions on pulp and periapical inflammation in the succedaneous teeth.

A pioneer in auto-transplantation of teeth, Dr. Andreasen gained essential information from eight experiments in monkeys. He reported on the effect of damage to the dental follicle, the position of the transplant in the alveolus, periodontal healing after auto-transplantation, the repair processes in the cervical area, the effect of splinting, damage to Hertwig's epithelial root sheath, reinnervation, the influence of endodontic treatment, and supra-alveolar periodontal healing.

Dr. Andreasen stimulated research colleagues in other countries to carry out similar studies using his methodology. Extensive studies were carried out at the Karolinska Institute in Stockholm, Sweden, studies that added further knowledge on healing of replanted teeth after storage in various media, the effect of antibiotics and the application of novel intra-canal medications. In addition, a detailed study of tooth ankylosis was carried out using the Copenhagen monkey model. These *in vivo* experiments in the 1970s, 1980s, and early 1990s laid the foundations for a clearer understanding of healing processes following replantation of teeth. The knowledge derived from those studies in Copenhagen and Stockholm became the platform for the further development of the clinical management of replantation and transplantation of teeth.

One can only marvel at Dr. Andreasen's seemingly endless enthusiasm and energy. In addition to the animal research and publications, clinical commitments and demands as a guest lecturer, Dr. Andreasen published the second edition of his textbook, *Traumatic Injuries of the Teeth* in 1981. This edition included two new chapters relating specific aspects of the management of traumatized teeth: Dr. Miomir Cvek on endodontic treatment, and Drs. Lars Goldson and Olle Malmgren on orthodontic treatment. He also continued the research on clinical records from the data base he had established and in collaboration with Dr. Frances Andreasen included investigations into transient tooth resorption following luxation injuries and root fractures, and root canal obliteration following luxation injuries.

Dr. Andreasen's replantation and transplantation experiments coupled with his other long-term collaborative clinical studies culminated with the publication in 1990 of the *Atlas of Replantation and Transplantation of Teeth*, a book that remains a classic. In the same year, he also published with Dr. Frances Andreasen the first edition of another book entitled *Essentials of Traumatic Injuries to the Teeth*. This was followed in 1993 by the significantly expanded third edition of *Traumatic Injuries of the Teeth*. Co-edited by Dr. Frances Andreasen, this beautifully illustrated, extensive textbook consisted of 22 chapters and included 21 contributing authors. It was hailed as a classic textbook which graced university libraries worldwide.

During the 1990s, Dr. Andreasen's collaborative research publications continued at the usual rapid pace; the topics ranging from practical issues such as long-term survival of fragment bonding of

fractured crowns to four classic studies of 400 avulsed teeth, co-authored with Drs. Mette Borum, Henrik Loft Jacobsen and Frances Andreasen. His research into tooth transplantation also continued with important collaborative long-term studies published with Drs. Ole Schwartz and Hans Ulrick Poulsen.

In 1997, Dr. Andreasen published yet another textbook, but this time it was in his professional role as an oral surgeon. The title was *Textbook and Color Atlas of Tooth Impactions* and was co-authored with Drs. Jens Kølsten Petersen and Daniel M. Laskin.

One of Dr. Andreasen's many concerns about dental traumatology was that it seemed to be a neglected area in dental education curricula. Dental students could benefit from convenient access to information about dental injuries. That led to the publishing of *Traumatic Dental Injuries—a Manual* in 1999, updated in 2003 and a third edition in 2011, co-edited by Drs. Frances Andreasen, Leif K. Bakland, Maria Teresa Flores, and Lars Andersson. The manual caught the attention of practicing dentists also and became very popular as a quick and reliable reference for dental trauma treatment recommendations (Figure 5). It was published in several languages and served as a handy guide until it was replaced by the easily accessible Internet-based *Dental Trauma Guide* (see below).

The 21st century dawned and in the 20 years until his untimely death, Dr. Andreasen authored or co-authored over 170 additional research articles and book chapters. The 21st century commenced with the publication of second edition of the *Essentials of Traumatic Injuries in Teeth*, co-authored with Dr. Frances Andreasen, followed by numerous research publications. Of significance was his collaboration with his close professional friend, the late Dr. Miomir Cvek from the Eastman Institute in Stockholm. They pooled their clinical records, particularly in respect to root fractures, which resulted in several landmark studies and publications detailing responses recorded in 400 patients.

The fourth edition of *Traumatic Injuries of the Teeth* was published 2007 during the new era of implants and the new edition embraced their significance. Co-edited by Drs. Frances Andreasen and Lars Andersson, the textbook was expanded to 35 chapters with 40 contributors. An entire chapter was devoted to implants in the anterior region, while new materials and restorative techniques were also discussed, all with the aim of either maintaining a traumatized tooth or providing an esthetic and biologically stable replacement.

Other studies followed, many again with Dr. Frances Andreasen, his major scientific collaborator for over 40 years and with Dr. Eva Lauridsen. Dr. Lauridsen, a pediatric dentist with a research and clinical background, joined Dr. Andreasen's research team in 2006. Her collaborative publications addressed the risk of healing complications in teeth with combination injuries, alveolar fractures, and a variety of injuries in primary teeth as well as further long-term studies with replantation of permanent teeth.

The 5th edition of *Traumatic Injuries of the Teeth*, published in 2019 with 59 contributors from many countries, was expanded to 44 chapters. This unique, monumental textbook will remain as one of the many outstanding legacies Dr. Andreasen has so generously provided for the dental profession (Figure 6).

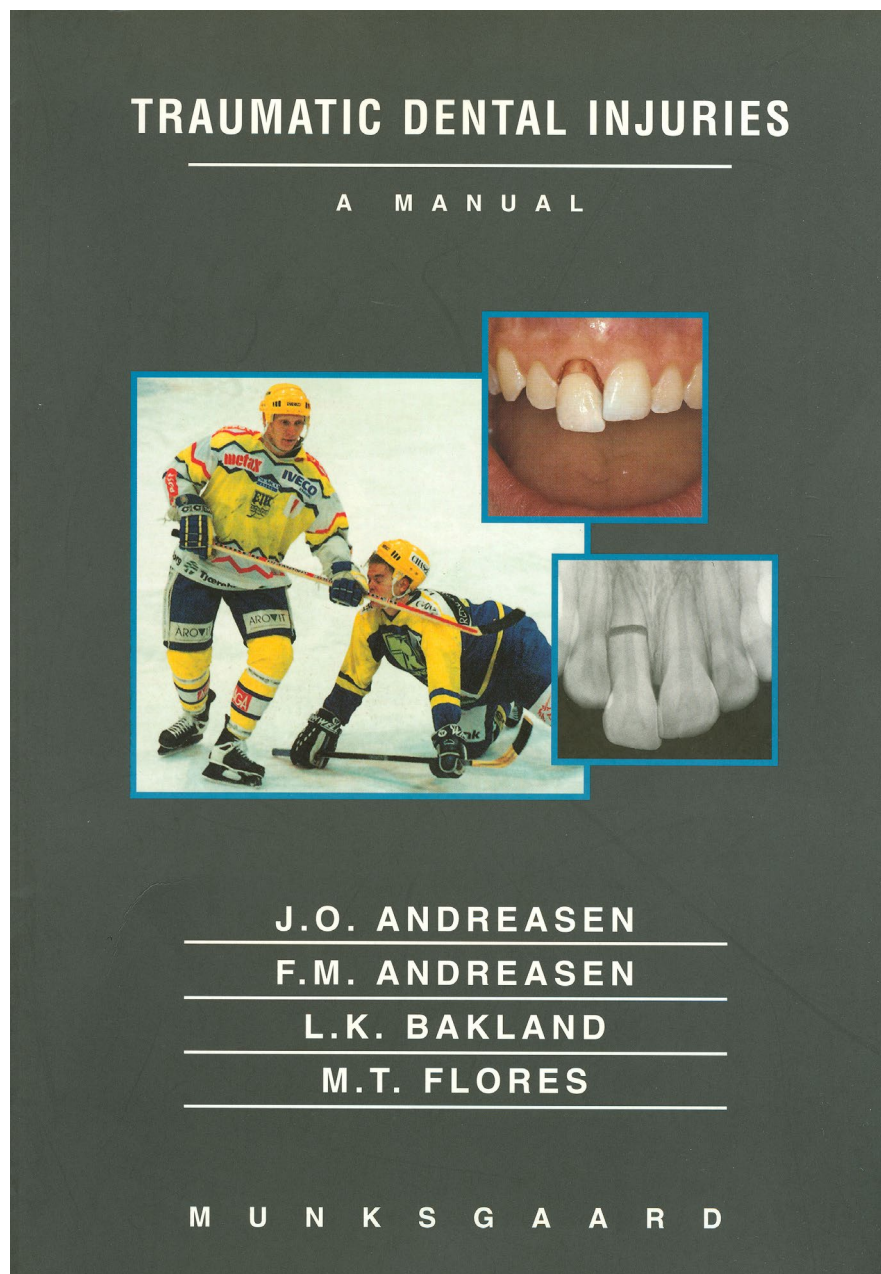


FIGURE 5 Traumatic Dental Injuries—A Manual. 1st edition, 1999

During Dr. Andreasen's meritorious history of research, he worked with many collaborators—in fact too many to name. However, it is certain that each one of them was inspired by Dr. Andreasen's endless enthusiasm, energy, deep knowledge, and ongoing desire to improve the management of dental injuries inflicted on victims of dental trauma.

3 | A PARADIGM OF INTERDISCIPLINARY APPROACH TO DENTAL TRAUMA

Advances in dentistry have often benefitted from collaborative efforts and input from all branches of the profession. Dr.

Andreasen early on realized that a single dental specialty could not alone cover the entire field of dental traumatology. The complexities of these injuries, involving bone, periodontal ligament, and tooth structures including the dental pulp, indicated that a combined effort by all dental disciplines was required. To that end, he reached out to both the general dental community and the specialty disciplines.

In the 1970s, Dr. Andreasen lectured frequently and gave courses in Scandinavia on a new paradigm for understanding both healing and complications after dental trauma based on his research findings. This was an important step forward on how to treat dental injuries in an interdisciplinary way. He attracted specialists and general dentists to his courses in which he had put in enormous efforts

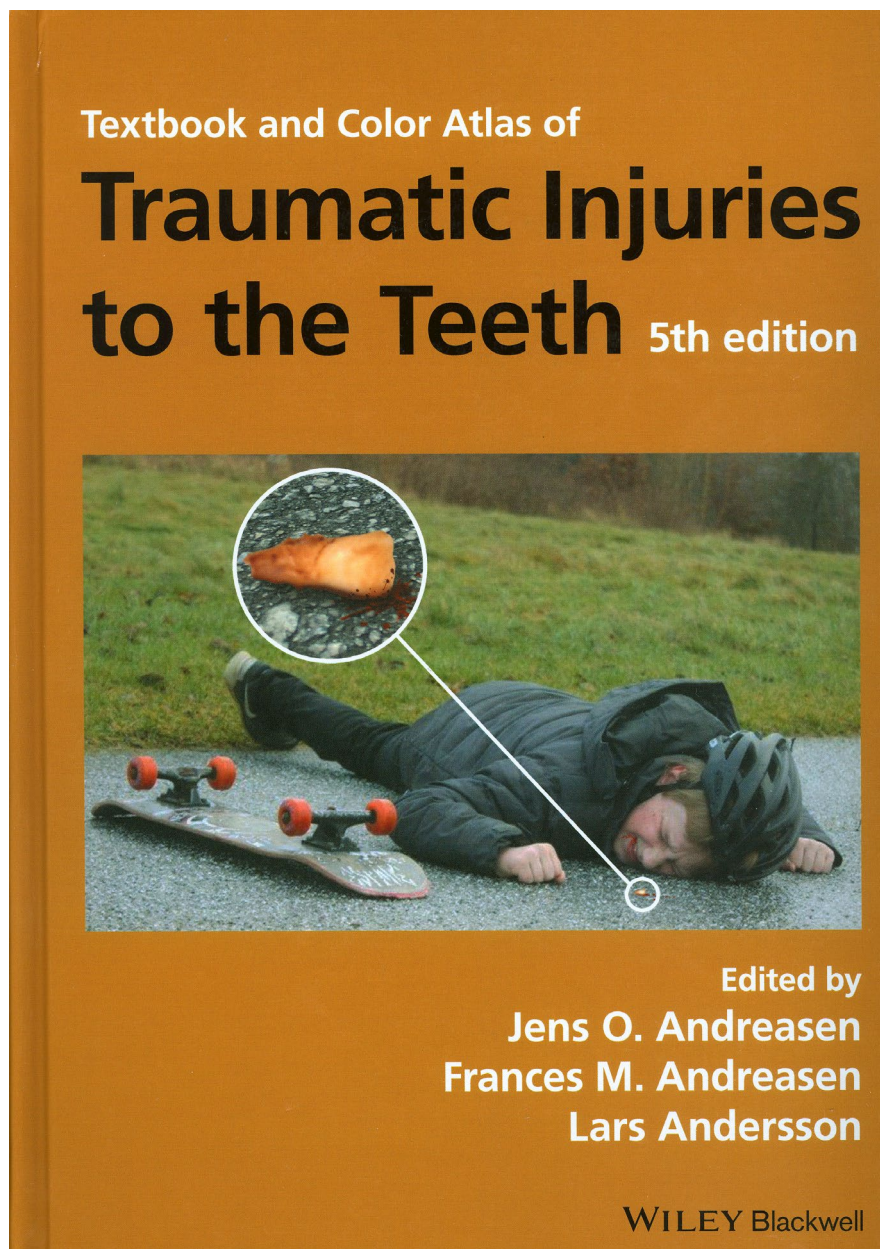


FIGURE 6 Traumatic Injuries of the Teeth, 5th edition, 2019

to present advanced information and cutting-edge treatment methods. His presentations were also cutting edge, which at that time included the use of three side-by-side slide projectors to be able to simultaneously present clinical, radiographic, and histological slides side-by-side.

He loved to engage the course participants in case discussions; this was an opportunity for him to gain feedback on clinical problems, which often initiated further development of new research and treatment approaches.

As a result of Dr. Andreasen's pioneering work in the 1970s and his ability to lead and stimulate colleagues, many new research groups were started in Scandinavia. In the 1970s and 1980s, considerable numbers of research papers in the field of dental traumatology and auto-transplantation of teeth originated from these

countries. Dr. Andreasen realized that it was time to spread his dental trauma paradigm worldwide.

4 | REACHING OUT INTERNATIONALLY

One of the organizations that already in the 1970s began to recognize the importance of dental traumatology was the American Association of Endodontists (AAE). Dr. Andreasen gave his first lecture to this group of specialists at the 1976 AAE Annual Session on the topic of tooth luxations. He became a frequently invited speaker at AAE Annual Sessions and this connection with the AAE grew steadily over the succeeding years. He was awarded Honorary Membership in the AAE in 2001 and received financial support

from the AAE with a grant of \$60,000 to help develop the Dental Trauma Guide (DTG) (see later). He continued to travel to the United States to lecture and participate in various conferences. His last visits to the United States were to attend the 20th World Congress on Dental Traumatology (WCDDT) in San Diego, co-sponsored by the International Association of Dental Traumatology (IADT) and the AAE, and a while later, in January, 2020 to lecture at the Yankee Dental Congress in Boston, Massachusetts. The latter lecture was also his last presentation outside his native Denmark (Figure 7).

That Dr. Andreasen had an influence on the AAE in terms of traumatology is noted in activities that took place in the endodontic community. The AAE *Guidelines for Treatment of the Avulsed Tooth* was published in 1983, and the next year, 1984, the First International Conference on Oral Trauma, sponsored by the AAE, was held in Dallas, Texas. Addressing various areas of dental trauma were the following clinicians: Drs. Frances M. Andreasen, Jens Ove Andreasen, Miomir Cvek, George A. Zarb, Stephen J. Moss, Ingeborg Jacobsen, Duane T. DeVore, Robert Walker, Raol G. Caffesse, Leif Tronstad, and Andrew E. Michanowicz. The interest in the field of dental traumatology was expanding.

The recognition that dental traumatology needed special attention inspired Dr. Jens Ove Andreasen and Dr. Frances Andreasen to invite Scandinavian colleagues who were involved in dental trauma research to join them on a roundtrip cruise between Stockholm, Sweden and Helsinki, Finland to brainstorm ideas about how best to develop and promote concepts that would benefit dental traumatology worldwide. That February, 1989 cruise resulted in the idea of creating an international association devoted to dental traumatology.

Later that same year, a world conference on accident and injury prevention was held in Stockholm. The conference was for the medical community and a document was adopted at the conference called the Stockholm Manifesto on Accident Prevention. Immediately following that conference, on September 21, 1989, Dr. Andreasen and his colleagues held the 2nd World Congress on Dental Traumatology (WCDDT) (Figure 8). That is when the International Association of Dental Traumatology (IADT) was created. A Board of Directors was chosen and Dr. Andreasen was elected President, a position he held for the next 12 years.

The next WCDDT, the 3rd, was held in Copenhagen and was the first WCDDT sponsored by the IADT. That was when the "Harald

Blue Tooth Diploma" was introduced as a certificate of attendance. It was also the beginning of a decade of WCDDTs held almost every year in many locations around the world (Table 1). At the 1993 Congress in London, the participants cheered when Dr. Andreasen was "knighted" with the "Order of the Garter" during the Congress Banquet. The interest in dental traumatology was growing steadily with the exposure through the many world congresses.

The 10th WCDDT held in Melbourne is remembered by many for the unique opening event: a technician assisting Dr. Andreasen set up for his presentation, tripped and fell off the stage and apparently knocked out two front teeth. There was a moment of complete silence among the 600 delegates watching. However, everything had been secretly arranged between the organizers and Dr. Andreasen. The teeth were made of plastic and the technician was a stuntman, and Dr. Andreasen could open his lecture by showing how dental trauma can happen anywhere, anytime.

After the 12th WCDDT in 2001 in Boston, the succeeding conferences, also held in many diverse locations around the world, were scheduled approximately every other year with the 20th and the last so far, held in San Diego, California. The COVID-19 pandemic abruptly prevented the 21st WCDDT from being held in Lisbon, Portugal in 2020, but it has been rescheduled for Lisbon in May, 2022.

In 2012, the 17th WCDDT was held in Rio de Janeiro and that was the only conference that Dr. Andreasen missed of the 20 that have been held. Ironically, the reason for missing the conference was that an icy sidewalk accident resulted in a serious blow to his head that prevented any travel for the rest of the year. It almost ended the career of one of the world's pre-eminent experts on trauma, but fortunately for him and the world of dental traumatology, he recovered after a long convalescence.

The Congresses that have been conducted in the past three decades have all succeeded in raising the interest in dental trauma everywhere and stimulating many local trauma conferences in various locations worldwide. The membership of the IADT has been steadily growing and a new IADT Facebook page has contributed to increased attraction of young clinicians and researchers. The IADT Fellowship has developed into an attractive official recognition of knowledge and experience in the field. Information about the IADT is available on the IADT website: www.iadt-dentaltrauma.org

5 | THE COPENHAGEN SYMPOSIUMS

To provide additional opportunities for dentists to catch up on the latest information related to dental traumatology, Dr. Andreasen and his colleagues at the University of Copenhagen began in 2011 to host the Copenhagen International Symposium in Dental Traumatology. The yearly symposiums have provided an opportunity for researchers and clinicians to share experiences and provide cutting-edge information for interested dentists from many countries.

The symposiums were "user friendly" in the sense that participants could interact on an informal basis with the speakers, ask questions and discuss cases. Dr. Andreasen enjoyed the informal



FIGURE 7 Dr. Andreasen kept up a busy schedule lecturing into his 85th year

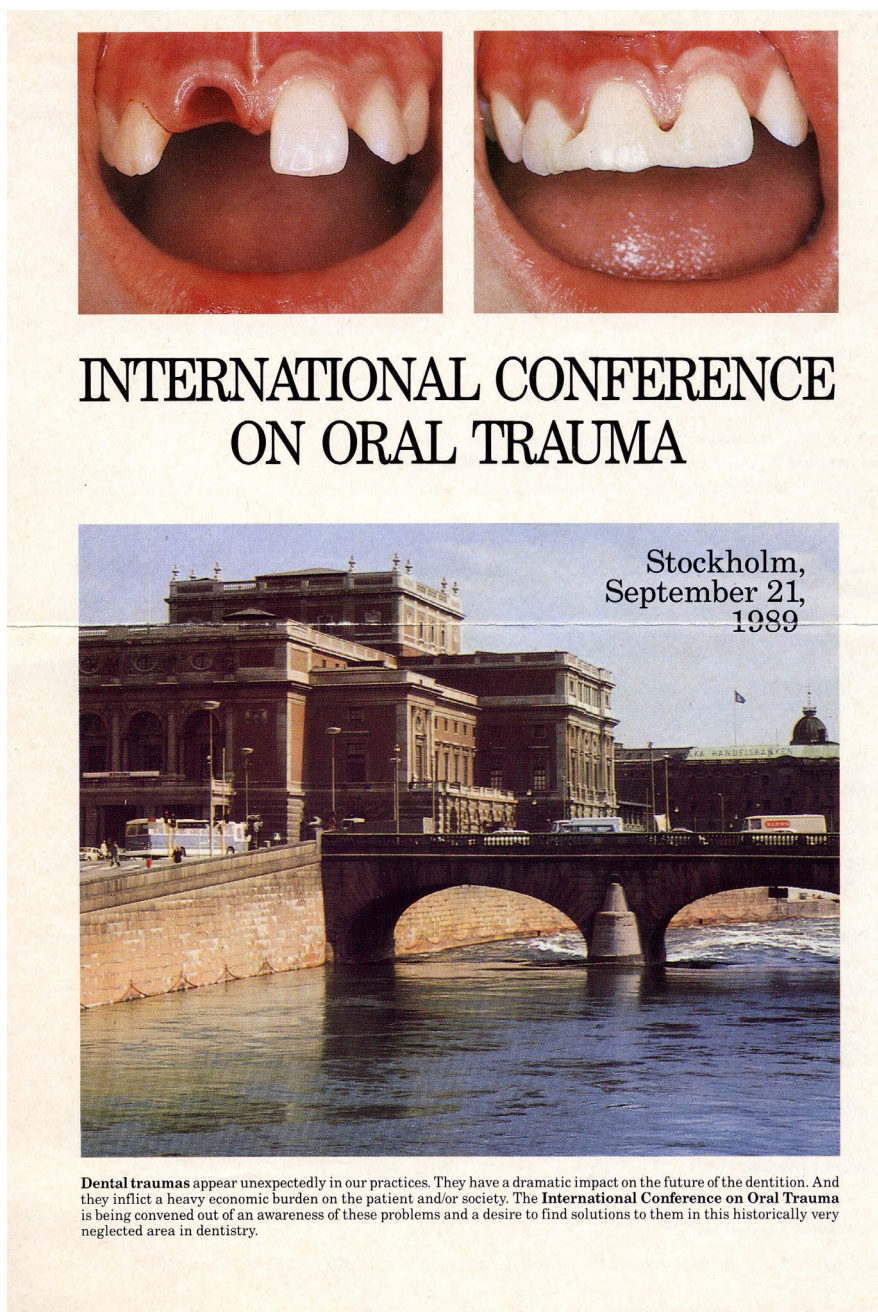


FIGURE 8 Program for the 1989 Trauma Conference in Stockholm, when the IADT was established

settings and friendly interactions and took great pleasure in finding out the number of countries represented by the participants. These symposiums have met a perceived need and will be continued as part of Dr. Andreasen's legacy.

6 | THE IADT JOURNAL, *DENTAL TRAUMATOLOGY*

A new dental journal was established in 1985 that was to prominently include dental traumatology: *Endodontics and Dental*

Traumatology with Dr. Leif Tronstad as the first Editor-in-Chief. That journal was selected by the Board of Directors of the newly formed IADT in 1989 to be the official journal for the Association. Dr. Tronstad served as editor for 15 years (1985-2000) and the journal provided the opportunity to publish clinical and research articles on dental trauma. Over the years, Dr. Andreasen has been the greatest contributor to the publication of articles in the journal, with the Copenhagen University Hospital being a center for development of publishable data.

When Dr. Tronstad stepped down in 2000, the new Editor-in-Chief, Dr. Martin Trope, took over the editorship of a renamed

TABLE 1 World congresses on dental traumatology

1	1984	Dallas, Texas, USA
2	1989	Stockholm, Sweden
3	1991	Copenhagen, Denmark
4	1993	London, United Kingdom
5	1994	La Jolla, California, USA
6	1995	Tokyo, Japan
7	1996	Florence, Italy
8	1997	Guarujá, Brazil
9	1998	Eilat, Israel
10	1999	Melbourne, Australia
11	2000	Oslo, Norway
12	2001	Boston, Massachusetts, USA
13	2003	Santiago, Chile
14	2005	Reykjavik, Iceland
15	2008	Nagoya, Japan
16	2010	Verona, Italy
17	2012	Rio de Janeiro, Brazil
18	2014	Istanbul, Turkey
19	2016	Brisbane, Australia
20	2018	San Diego, California, USA
21	2020	Lisbon, Portugal. Postponed due to the COVID-19 pandemic. Rescheduled for Lisbon, May, 2022.

journal: *Dental Traumatology*. Dr. Trope, who at the same time took over as President of the IADT from Dr. Andreasen, was in favor of the name change as were most IADT members, including Dr. Andreasen. The IADT now had a journal that was totally dedicated to the topic of dental trauma with an interdisciplinary approach to management of this dental problem.

Increasing the inclusiveness of the journal led to it also becoming the official publication for the Academy for Sports Dentistry. Both the guidelines and the involvement of all groups interested in promoting research and clinical management of traumatic dental injuries, were examples of ideas Dr. Andreasen had promoted his entire professional life.

Further development of the journal came, when in 2007, Dr. Lars Andersson became Editor-in-Chief. He established specific sections, with Associate Editors, to handle the great diversity of dental traumatology. *Dental Traumatology* has grown in importance and general recognition, and has provided another opportunity for Dr. Andreasen's vision and goal to be realized. Dr. Paul Abbott became the 4th Editor-in-Chief in 2016, continuing the vision of Dr. Andreasen to disseminate evidence-based dental trauma information.

7 | GUIDELINES FOR TRAUMATIC DENTAL INJURIES

Early in a lifetime devoted to improving the care of patients with traumatic dental injuries, Dr. Andreasen pointed out that the problem was a public health problem that needed more attention. One



FIGURE 9 IADT Board of Directors meeting in Dublin, Ireland, Jan. 25, 2020. Back row (l-r): Z. Cehreli, A. O'Connell, A. Oginni, L. Levin, C. Bourguignon, G. Tsilingaridis. Front row (l-r): B. Kahler, M.T. Flores, J.O. Andreasen, L. Hicks



FIGURE 10 Dr. Andreasen working with Dr. Eva Lauridsen on the Dental Trauma Guide in 2015

way to address the issue would be to develop guidelines to assist dentists and other health care providers in the evaluation and management of such injuries. Some professional organizations such as the AAE in collaboration with the IADT began to develop guidelines in the 1990s.

The collaboration was facilitated by dentists who were active in both organizations, including Dr. Martin Trope, who became the second President of the IADT (2001-2002) and the second editor of *Dental Traumatology* (2001-2006). Based on Dr. Trope's recommendations, the AAE adopted the IADT Guidelines into its own specialty guidelines.

The initial IADT Guidelines were published in the first issue of *Dental Traumatology* (Feb. 2001) in which Dr. Trope served as Editor. Dr. Marie Therese Flores from Chile led the IADT committee developing the document. The most recent Guidelines were published in the journal in August, 2020.

The IADT Guidelines served as the basis for a novel smart phone trauma app developed by Dr. Ulf Glendor in Sweden in 2011 with encouragement from Dr. Andreasen. It was intended for the public in general, but could also be of assistance to all health care providers. A similar trauma app (ToothSOS App) was subsequently developed and made available by the IADT. An updated version of the app for the public at the scene of an accident and based on the 2020 IADT Guidelines is now available. The updating of the Guidelines was one of the last such activities in which Dr. Andreasen was able to participate and contribute (Figure 9).

8 | THE DENTAL TRAUMA GUIDE—A GIFT TO THE WORLD

As information about dental trauma increased through research and clinical data collection, Dr. Andreasen again sought a new cutting edge—this time a way to disseminate important clinical information about traumatic dental injuries to dentists everywhere in the world, from a busy big city dental office to a clinic in an underdeveloped

region of the world. Complicating the issue for many dentists was that so many different trauma entities existed, including trauma combinations. Lectures, journal articles, and textbooks are important, but do not reach a large number of clinicians. Dentists and other health care providers need readily available best advice for the unexpected arrival of a patient with a traumatic dental injury. A new approach was necessary.

Around 2006, Dr. Andreasen began working on the concept of providing dental trauma information through the Internet and his novel idea happened to coincide with a revolutionary advancement in information technology—the release of the smartphone. Accessing information was becoming more easily accomplished everywhere in the world. To provide such information about management of dental injuries, the tool that was needed was a dental trauma guide available on the Internet. As usual Dr. Andreasen was years ahead of his time in developing new tools for sharing information with dentists worldwide.

To develop an Internet-based guide, Dr. Andreasen gathered a group of experts in various fields: An engineer—Søren Steno, a graphic designer—Tue Fredgaard, a professor in biostatistics—Thomas Gerds, and a fellow dental researcher—Dr. Eva Lauridsen. The goal was to create a Dental Trauma Guide (DTG) that would contain information about specific dental injuries, examination details, diagnostic clues, and treatment options. All the information would be evidence-based from the scientific literature in dental traumatology (Figure 10).

Clinical data for establishing treatment options came from the collection of more than 40 000 dental trauma patient records that Dr. Andreasen had established at the Copenhagen University Hospital beginning in the late 1960s. From this large data base, 4000 cases were selected that had long-term follow up. This database covered all trauma entities as well as combination injuries in permanent and primary teeth. The risk of various outcome complications such as pulp necrosis, pulp canal obliteration, repair-related root resorption, infection-related root resorption, ankylosis-related root resorption, marginal bone loss, and tooth loss was estimated based on survival analysis. The statistical analysis was performed in collaboration with the Department of Biostatistics, University of Copenhagen.

The DTG was developed using the clinical data described along with research data from the growing pool of published dental traumatology information and incorporated the dental trauma treatment guidelines developed by the IADT. To make treatment descriptions easily understood, film animations were created and incorporated in the DTG.

The DTG website was launched in 2008 and within a few years it had been accessed in 180 countries with more than 2 million page-views per year. Funding for the development and initial operation of the DTG website came from grants from several dental organizations such as the IADT, the AAE, the European Academy of Paediatric Dentistry (EAPD), the American Academy of Pediatric Dentistry (AAPD), the Hellenic Society of Paediatric Dentistry (HSPD), the Swedish and Danish Paediatric Societies, and the Velux



FIGURE 11 Dr. Mitsuhiro Tsukiboshi and Dr. Andreasen at the 15th WCDDT in Nagoya, Japan, 2008



FIGURE 13 Dr. Andreasen was named Fellow of the Royal College of Surgeons in London in 1991



FIGURE 12 DTG Board of Directors, 2018, (l-r): T. Holberg Fog, P. Folke Christensen, M. Leindals, L. Rybner, J.O. Andreasen, L. Andersson, E. Lauridsen, T. Kofoed, S. Storgaard-Jensen

Foundation of the Danish Regional Fund. Personal contributions including his own, played a big role in supporting the availability of the DTG; an important major donation came from Dr. Tsukiboshi Mitsuhiro, Nagoya, Japan. A very active supporter of both the IADT

and the DTG, Dr. Tsukiboshi served as the IADT President in 2009-2010 (Figure 11).

Ten years after the launching the DTG website, it became evident that a total reprogramming of the site was necessary. By then it had

grown to nearly 300 pages and the cost of reprogramming and running the website was no longer feasible solely by donation support. While the initial intent was for this program to be free to all users, it now became necessary to convert it from a free website to a low pay-for service one. The DTG was consolidated as a non-profit organization with a Board of Directors, including Dr. Lars Andersson and Dr. Eva Lauridsen as well as representatives from the Danish dental associations and Copenhagen University Hospital. It was important for Dr. Andreasen to secure the viability of his life work in the future (Figure 12).



FIGURE 14 Dr. Andreasen was made Knight of the Order of Dannebrog in Copenhagen in 2005

The development of the DTG with its groundbreaking Internet-based approach to the sharing of information about dental traumatology was the culmination of a lifetime of tireless effort to understand the causes, to develop treatment procedures, and to evaluate the outcomes of traumatic dental injuries. Dr. Andreasen began that long road as a 9-year-old boy with a bicycle accident, experiencing a common, but at the time poorly understood dental problem.

The DTG website is available at: www.dentaltraumaguide.org

9 | CONCLUSION—THE FATHER OF DENTAL TRAUMATOLOGY

Dr. Andreasen earned worldwide recognition for his work. It highlights the success he had in developing and disseminating information about the care of patients with dental injuries. Educational institutions and professional organizations take pride in honoring individuals who have contributed extensively to the knowledge in various educational fields. Dr. Andreasen received an honorary doctorate from the Karolinska Institute in Sweden and was awarded honorary degrees from universities in four countries in addition to being named Fellow of the Royal College of Surgeons in London (Figure 13). Nine professional dental organizations in seven countries awarded him with honorary membership for his role in improving the care of dental trauma patients. In total, he was recognized with 28 awards from countries around the world.

An award that perhaps touched him more than any other was when in 2005 he was made Knight of the Order of Dannebrog in his native Denmark (Figure 14). The award was presented to him by Queen Margrethe II for his lifetime meritorious service in health care.



FIGURE 15 Dr. Andreasen loved traveling with his wife, Dr. Anna-Lena Hallonsten. Here they are enjoying a visit to Mt. Fuji in Japan in 2004

One aspect of Dr. Andreasen's life, observed by many, was that he was not restricted in his interests to only the scientific side, but also very much to human contact. He stressed that the psychological impact of an injury also deserved attention, perhaps in part based on his own childhood trauma experience.

His devotion to sharing his knowledge with the world and doing all he could to reach out to colleagues everywhere, did not keep Dr. Andreasen from devoting time and attention to his family. He loved spending time with his grandchildren and involved his daughters and his wife in many activities. Traveling for him was a pleasure, perhaps inherited from his Viking past (Figure 15).

Reaching out to people, he was driven by high energy and passion. In spite of a hip injury in March, 2019, he later that year traveled to Mexico to lecture. Although he had already achieved such major accomplishments as publishing about 400 scientific articles and several textbooks, Dr. Andreasen refused to wind down. He was involved with colleagues on several manuscripts until the very end, one month after his 85th birthday.

A life well lived. As pointed out by his daughter Dorte Helleberg, her father lived in a way well described by Shakespeare: *The meaning of life is to find your gift. The purpose of life is to give it away.* Dr. Jens

Ove Andreasen gave to the world the gift of a life devoted to finding ways to reduce the physical and mental pain of traumatic dental injuries.

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SUPPORTING INFORMATION

Additional supporting information may be found online in the Supporting Information section.

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