Evidence-based, regulatory-compliant development of medical products using the example of the DIR® System 2

Introduction

Medical technology is a comparatively young engineering science and has only been operated since the introduction of European regulation in the 1990s, not only from the technical point of view, but also from the medical scientific angle of view. The connection between technology and medicine has brought great progress in diagnosis, therapy and prevention in recent decades. This is especially true for dental medicine and dental technology. There are numerous products on the German and international market. But it is time to separate the wheat from the chaff. Evidence-based product development is comparatively recent. Many companies make statements about the efficacy of their products which are neither proven nor demonstrated by evidence-based medical studies, or by theoretical considerations tested under laboratory conditions. Evidence-based product development is now also legally anchored, but is neglected by many companies with gross negligence. It is precisely here that the chaff separates from the wheat. It is not enough to have an idea to develop a product and bring it into the market without the obligation to fill studies and proof of efficacy. The principle applies: No assertion without proof. No product without compliant approval. Therefore, dentists and dental technicians should choose a medical device that meets these scientific and legal requirements. The DIR® System 2 of the DIR® GmbH and Co KG meets all these requirements and is an ideal example of the presentation of the subject.

Legal requirements for medical devices

The following section is intended to provide an overview of the legal requirements and scientific evidence to be provided or to be classified.

In the European Union, the EU Directive 93/42 / EEC applies to medical devices. This EU Directive was introduced in 1993 and subsequently implemented into national legislation in the Member States. In Germany, the directive can be found in the Medical Devices Act (MPG) and the Medical Device Operators Regulation (MPBetreibV). The legislation regulates the legal, normative and technical-scientific requirements for medical products. The product registration is based on two pillars. The primary column consists of a quality management system according to DIN EN ISO 13485. The quality management system is certified and regularly monitored by a Notified Body. Notified bodies are e.g. BSI, DEKRA, MEDCERT or TÜV. The business processes are monitored and their conformity with the regulatory requirements is ensured. The second pillar is product monitoring. Depending on the product risk, which is described by risk classes I, I (m), I (s), II (a), II (b) and III.

The risk class according to the intended purpose, which determines exactly what the product is intended for. This also means, for which it is not intended. This purpose is then binding for the users of the respective product. The DIR® System 2 is classified in risk class I(m), since it is a medical or dental product with measuring function. The "m" stands for measuring function and the I for a comparatively low patient risk. The system is used in a natural opening (mouth / mouth). The legislature foresees that, in the case of products of risk class I, only a monitoring of the quality management system must take place. Products with the risk classes I(m), I (s), II(a), II(b), and III are subject to a product monitoring system in addition to the quality management system. The risk class is to be specified in the operating instructions of Medical devices that measure a parameter must be assigned at least to the risk class I(m) or higher, some companies try to escape the monitoring at this point and write risk class I and point to the measuring function in the subordinate set This is inadmissible, in addition to the QM certificate according to ISO 13485, it is also important to have the certificate of conformity according to the EU Directive 93/42 / EEC shown in the manual,

the technical documentation or the Manufacturer's website, the product is subject to certification and monitoring and is therefore legally correct.

Regulatory, Evidence-Based Development of a Medical Device - What is it?

To answer this question, two aspects must be considered more closely. It must be clarified, "What does regulatory correct?" And "What exactly is evidence-based?" Regulatory correct means that a medical device meets all legal and normative requirements. Evidence-based means that the efficacy of the product has been demonstrated based on clinical trials and clinical evaluations. The example of the DIR® System 2, this means that the manufacturer who has established a certified Quality Management System the company DIR® GmbH and Co KG. It is also monitored by regular annual monitoring audits and every three years by recertification audits. Successful audits confirm that the quality management system fulfills all requirements. In addition to the quality management system, the product DIR® System 2 is certified, since it is a dental product with measuring function and is associated with the risk class I(m). BSI also certifies the product in this case. This means that BSI checks the measurement function, and is satisfied that the DIR® System 2 is working correctly. In addition to the measuring function, a correct documentation in the form of a technical product file must also be demonstrated, which shows that all regulatory requirements are met. This technical product is required by the EU Directive 93/42 / EEC for medical devices and by the new ISO 13485: 2016. The scope of a technical product file is defined therein.

Development of a technical product file in the international STED format according to ISO 13485: 2016 and the EU directive 93/42 / EEC.

- Identification of the manufacturer. Certificates for Quality Management System, product and possibly to suppliers, the parts of the development and production take over.
- Description of the product through information on the intended purpose of the product, risk class, for which patient population is determined,
indication, contraindications, safety notices.
- Detailed presentation of the development and manufacturing process.
- Lab tests, approvals and description of electrical, mechanical, biological and chemical properties and their safety according to ISO 60601, ISO 10993 and other product-specific or general medical device standards.
- Evidence of product safety and functionality similarity if there are medical software in accordance with DIN EN 62304.
- Proof of efficacy in clinical trials and evaluations according to ISO 14155 and MEDDEV 2.7.1.
- Proof of safety in a risk-benefit analysis according to ISO 14971.
- Evidence of compliant operating instructions, usability, packaging, labeling in accordance with DIN EN 980, ...
- Observation of one's own product on the market in the application, general market monitoring (also of competition with comparable products) to identify general and specific risks to the product application to evaluate and minimize.

How have the requirements for the product documentation and the proof of efficacy and safety of the DIR® System 2 been implemented?

Manufacturer:

DIR® GmbH & Co KG is certified according to ISO 13485 and fulfills all requirements of the EU directive 93/42 / EEC. The product can be certified by the notified body of the notified body BSI (British Standard Institute, the largest global notified body). All the requirements for the development of medical devices 93/42 /

EEC and the harmonized standards deriving therefrom have been developed and confirmed by the certification. The key suppliers for materials, sensors and electrics are also certified and are regularly monitored. In addition, the DIR® System Sensor has been patented by the European Patent Office as proof of technical innovation and the unique features of the product characteristics and methodology. This has also been investigated and confirmed in clinical trials.

Proof of effectiveness:
There were the following clinical studies performed to demonstrate the effectiveness of the DIR ® System 2:

- Behandlerunabhängige reproduzierbare Studie, A. Zöllner, A. Dietzel, Universität Witten/Herdecke
- Der Einfluss der verschiedenen Registriermethoden auf die Kondylenposition und elektro-myographische Aktivität, S. Linsen, H. Stark, A. Samai, M. Klitzschmüller Rheinische Friedrich-Wilhelms-Universität Bonn.
- Die Wirkung von Okklusions-schienentherapie bei CMD auf die cerebrale Steuerung der okklusalen Aufbissbewegung, M. Lotze, R. Lickteig, E.Weinert, B. Kordaß, Universität Greifswald
- Studie über die Auswirkung der DIR®-Schiene auf die Schnellkraft bei Sportlern mit CMD, I. Froböse, Universität Köln.
- Evaluierung der Kondylenposition in Abhängigkeit verschiedener Registrierpositionen und unterschiedlichen Kieferschließkräften, I. Sales Ruiz Arbulo, H. Stark, S. Linsen, Rheinische Friedrich-Wilhelms-Universität Bonn.
- Untersuchungen von Bewegungs-aufzeichnungen mit dem DIR®-System bei Patienten mit CMD. Dissertation L. Passin-Arnold
- Klinisch-radiologische Pilotstudie zur Evaluierung der physiologischen Kondylenposition im MRT, Rheinische Friedrich-Wilhelms-Universität Bonn.
- Untersuchung der Wirksamkeit einer zahnärztlichen Aufbisskorrektur bei Patienten mit Kopfschmerzen und CMD, F.J Saha, J. Poth, W. Kowalczyk, G. J. Dobos, Kliniken Essen-Mitte, Praxis Dr. Poth und Partner, Universität Duisburg – Essen

Development result: An electronic measuring system that is superior to manual measurement. Why?

The answer to this question is as follows: An electronic measuring system is capable of reproducibly reproducing the same process in a large number in a constant quality. This measuring process is valuable and delivers the same results regardless of the user. Computer systems and measuring electronics cannot be influenced by daytime, sleep deficit, time pressure and other subjective influences. A dentist as an examiner is not able to carry out a centric fixation analysis diagnosis with the same precision, because his precision is, so to speak, dependent on physical and psychological factors. These are e.g. stress private or at work, sleep deficit, illness, weather e.g. a sultry summer day and the fact that a human examiner is a biological system. However, biological systems are always subject to a variance or dispersion of their results. Examination results from human investigators inevitably contain this day form and natural spread of biological systems and consequently have a changing quality. A computer system with connected measuring electronics carries out measurements with the same quality. This consistent quality is then transferred to the results of the examination. This relationship has been demonstrated by the above studies. In addition, computer-assisted technologies for diagnostics and therapy are developing in other medical disciplines. The superiority of these technologies give people the consistent quality of diagnostic and therapeutic processes such as the use of DENTAL-CAD / CAM for prosthetics or the analysis of laboratory and imaging materials by the availability of comprehensive and rapidly available knowledge Database support.

Conclusion

The technical equipment in a dental practice and a dental laboratory is becoming more and

more important. Therefore, dentists and dental technicians must also provide intensive and complete information about the technical devices and medical devices in their business day.

But also for the product developers a regulatory-conform development, production and approval of a product, as well as its distribution and the application is a demanding task. The journey from a product idea to everyday use is often lengthy, cost intensive and unfortunately is also often avoided. For the dentist and dental technician, it is indispensable to buy medical products only from reputable manufacturers, which meet all legal requirements. The purchaser of the product (here: dentist and dental technician) is fully responsible for the application of medical devices when mistakes are made and are directly in the hands of the supervisory and investigating authorities. From a legal point of view, the user must prove that no errors were caused by the user, but the product was the cause of the error. A documentation of the treatment, the purchase of the medical device and the training to the product must be available without any gaps. In addition, the "small print" (product characteristics and application notes in the user manual) is binding for the buyer and should be checked at the very latest.

Author: Prof. Dr. Dr. h.c Frank Stein is a consultant for QM and product licensing in medical technology at "healthcare projects management & consulting" and teaches medical technology at "Riga Technical University" and "I. Arabaev Kyrgyz State University ". He has over 23 years of international experience in the research, development, production, market introduction and approval of medical technology and advises both the German small and middle enterprises and international group of companies customers.