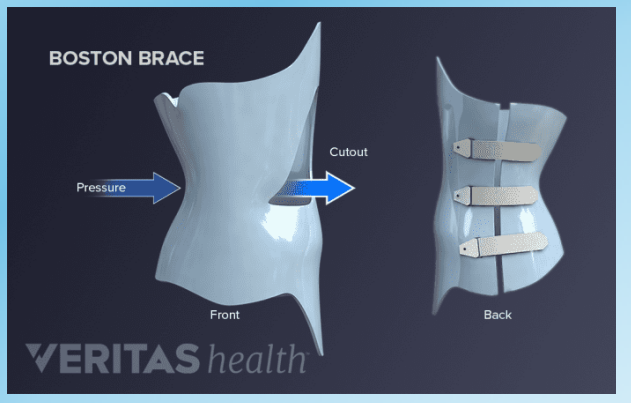
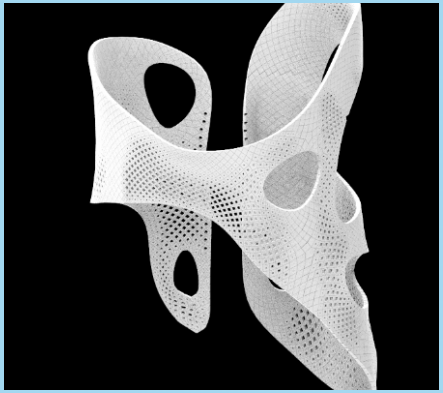
Orthotics & Prosthetics (Yesterday-Today-Tomorrow)

- There is little doubt that medicine has evolved throughout the years, but obvious visible changes have occurred in the PRM field.

- This short presentation will include visible basics of the evolution of Orthotics & prosthetics in the most common forms followed by a more detailed presentation by the technical experts.

Orthotics





What is 3D scanning?

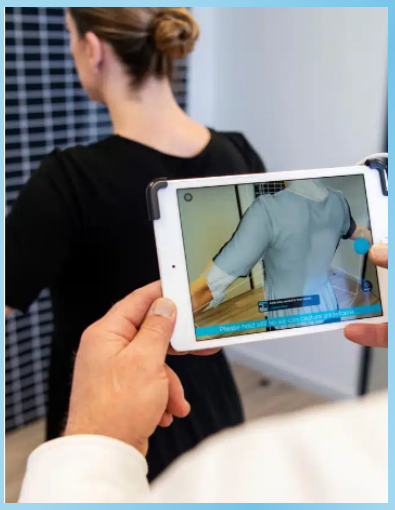
3D scanning, as a cutting-edge innovation, enables precise digital measurement of body parts without harmful radiation or laser light. It finds extensive application in designing and manufacturing orthotic devices, such as custom foot orthotics/insoles, spinal braces, and various supportive or corrective aids. Unlike traditional methods like physical measurements or plaster casts, 3D scanning provides Orthotists with a replica of the patient or the relevant body part to facilitate accurate orthosis design.

The primary advantage of 3D scanning lies in its ability to preserve and duplicate the initial image indefinitely. Once the scan is completed and saved, Orthotists can manipulate the duplicate copy as needed to create a device that meets the specific design and functional requirements.

Design software often incorporates simulation capabilities, enabling practitioners to assess the desired effect of the orthotic device on the patient model. If the simulated product falls short, the design can be easily modified or recreated using the original scan model. Moreover, the 3D scan can be archived for future reference, allowing follow-up scans to evaluate progress or compare outcomes.

3D braces

3D scanning images for scoliosis braces involves using a portable 3D scanner to create a precise 3D model of the patient's torso, often combined with digital X-rays and posture photos. This data is used by orthotists to design a custom brace with specialized software, allowing for precise measurements and the creation of a personalized, effective brace. The final product can then be manufactured using methods like 3D printing, resulting in a lighter, more cost-effective, and potentially better-fitting brace.



The process

- **Scanning**:

A healthcare provider uses a portable 3D scanner, sometimes combined with an iPad and specialized software, to capture a 360-degree scan of the patient's body in various postures.

- **Data integration**:

The 3D scan is combined with other clinical information, such as digital X-rays, to create a comprehensive digital model of the patient's spine and torso.

- **Custom design**:

CAD (Computer-Aided Design) software is used by expert designers to create the brace's 3D model. This process involves virtually adding pressure and relief regions, trimming the shape, and ensuring sufficient thickness for strength.

- **Manufacturing**:

The 3D model is exported as a file (e.g., STL) and used for manufacturing. One common method is 3D printing, where the brace is constructed layer by layer using materials like Nylon 12 or polypropylene.

- **Fitting and adjustments**:

After manufacturing, the brace is professionally fitted to the patient. Clinicians can make any necessary modifications for comfort or correction and will schedule follow-up appointments to monitor progress and make further adjustments as needed.

Benefits

- **Precision**:

3D scanning provides a more accurate and detailed representation of the patient's body shape than traditional methods like plaster casting.

- **Customization**:

The precise digital model allows for highly customized brace designs tailored to each patient's specific needs.

- **Efficiency**:

3D printing can lead to a faster manufacturing time and lower labour costs compared to traditional brace production.

- **Comfort and weight**:

Some 3D printed braces have been found to be thinner, lighter, and potentially more comfortable.

- **Non-invasive**:

3D scanning is a non-invasive and radiation-free diagnostic and measurement tool.

Future orthosis

- Future scoliosis braces will probably use integrated sensors to monitor pressure, wear time, and patient movement, allowing for real-time adjustments and remote patient monitoring by healthcare providers.
- Similar sensors could be also inserted in other orthosis as, for example, shoes and other aids. Research is ongoing……..

Prosthetics

Old prosthetic limbs were made from materials like wood, leather, and metal, and early examples include a 3,000-year-old Egyptian wooden toe and a Roman bronze and wood leg from around 300 B.C. Throughout history, these devices evolved from simple cosmetic replacements to more functional, mechanically-operated limbs using gears, cables, and springs, particularly advancing after conflicts like the American Civil war which spurred advancements in the prosthetic industry, with figures like Benjamin Franklin Palmer developing and patenting artificial limbs.

20th Century:

Major conflicts like World War I and II led to increased demand and significant improvements in prosthetic design and materials. Cable and spring control became more common, laying the groundwork for modern designs. Today in the 21st century, we are in the era of bionics.

Prosthetic models

Prosthetics - the future?

- Today in the 21st century, we are in the era of bionics and more importantly in an era of research trying to improve the way amputations are carried out to give better overall mobility to our patients.
- One is studying how muscles work through the contraction and relaxation of muscles (agonists & antagonists). This is usually done through proprioceptors that are related to the brain. Most of the amputations done result in a loss of this proprioception from the way the surgery is done. There is talk of a “biological joint” to restore proprioception resulting in benefits such as decrease of phantom limb pain, better use of the prosthesis and so on!
- That is tomorrow!