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DEFINITIVE GUIDE TO MATERIALS FOR ORTHOTICS:

Features
Scientific evidence
Benefits

This e-book was written in June 2022 by
the Biomech Consulting team.

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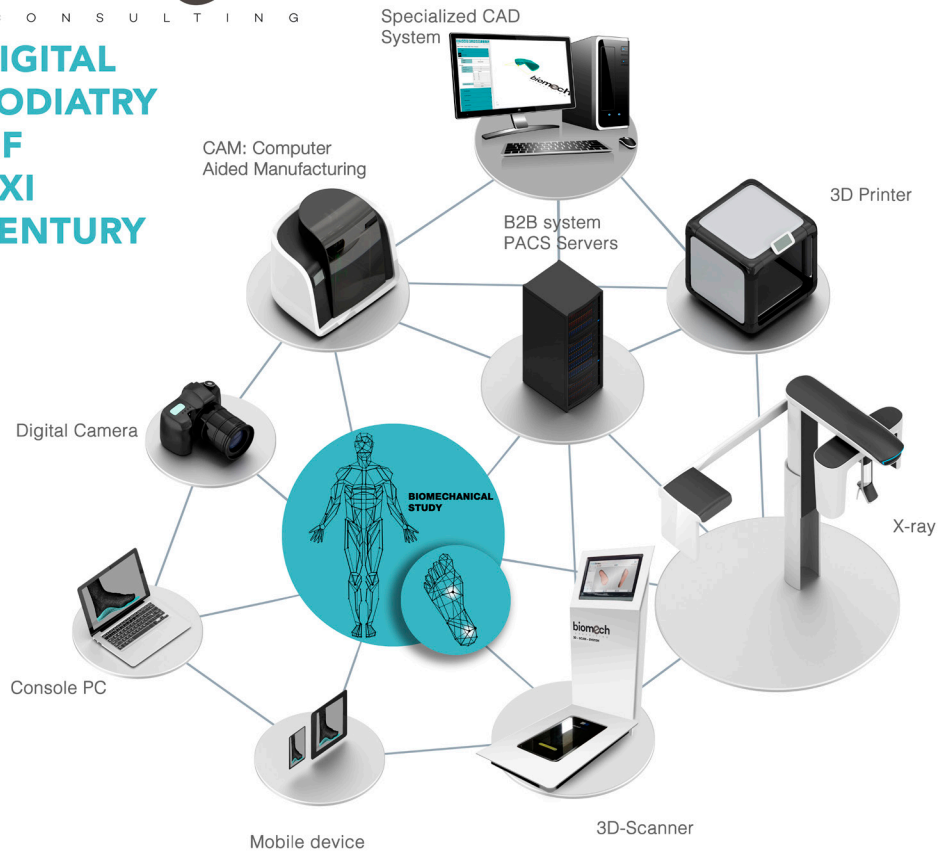
DIGITAL PODIATRY OF XXI CENTURY



Biomech Consulting is about many things: technological specialisation, digital work flows and personalised consultancy; creating synergies and turning every small clinic into a specialised biomechanics centre.

Over the last few years we have witnessed a digital revolution in the healthcare sector and, as with everything, this has its supporters and opponents.

The former see the advantages of certain medical procedures taking place without the patient being in the clinic, and the latter can see medical processes being standardised, certain healthcare professions disappearing and the promotion of the "consumption of health" process. .

But the truth is that the COVID-19 crisis has resulted in the exponential growth of these changes.

The digitalisation process is unstoppable and is transforming all healthcare procedures; the key is to see this technological progress as a tool for supporting clinical decision-making.

Therefore, far from dehumanising, digitalisation allows us to have more personal and efficient contact, and to involve the patient in the whole medical process.

Digitalisation and new technology, in the case of biomechanics and podiatry, involve super-specialisation, super-connectivity and, therefore, working in a network.

Globalisation, efficiency and networking are the three vectors on which healthcare services will pivot from now on.

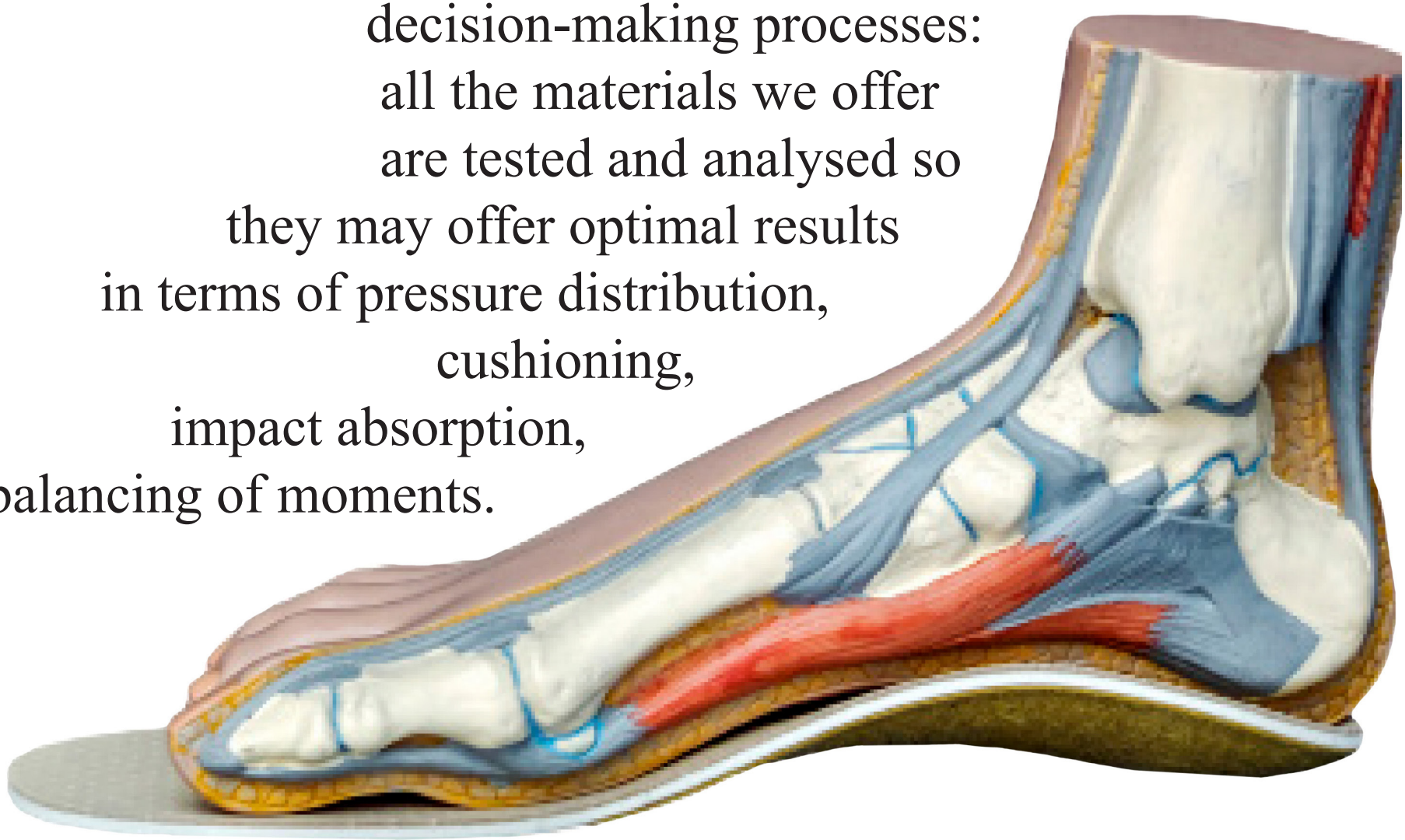
The podiatry of today cannot be centred around small clinics that are responsible for the whole process.
Information and data travel in real time, the answers must be in real time and synergies are becoming more and more important.

B2B systems allow us to manage and communicate diagnoses with indications in a structured, organised and effective way; PACS servers are systems for distributing radiology tests, networks without limits, involving sharing information while multiplying efficiency.

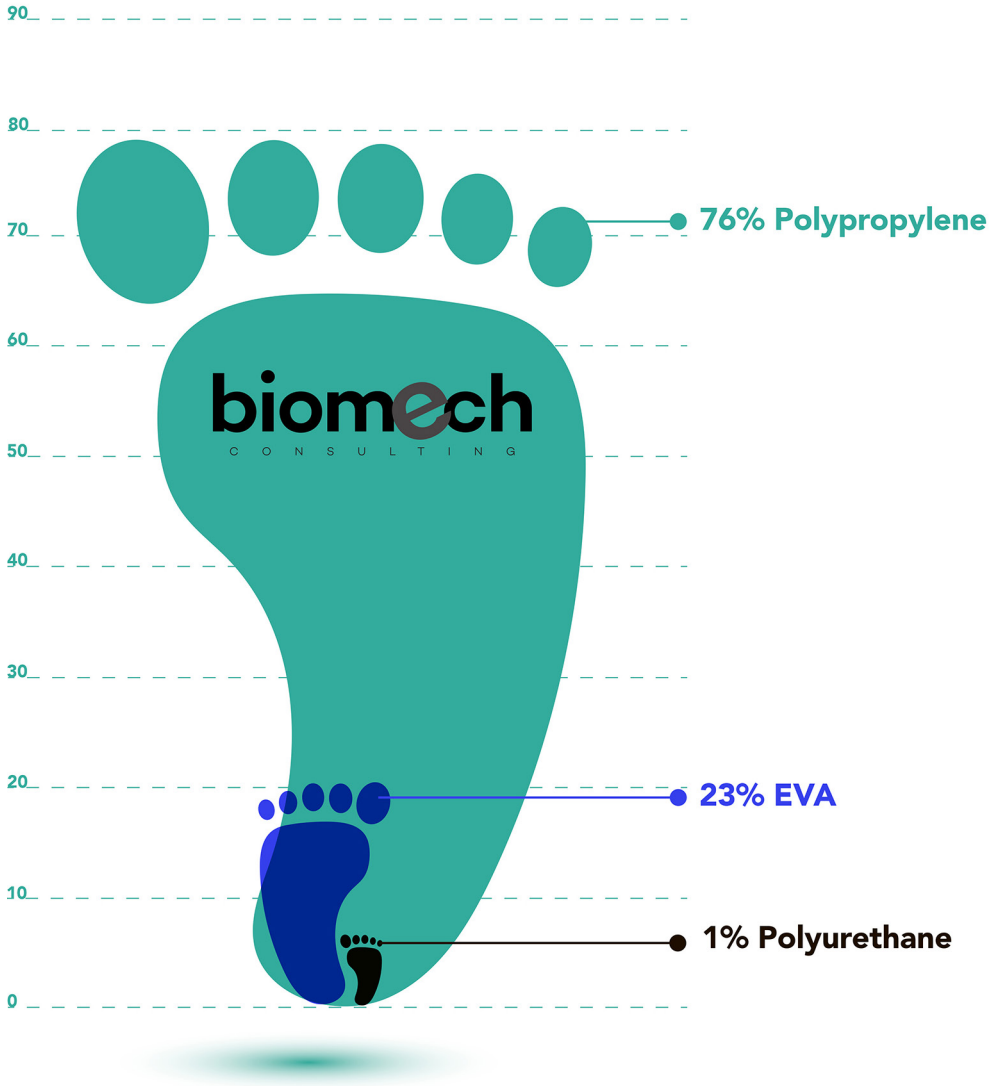
These days, patients expect to be provided with an experience when they visit the podiatrist and they want to take part in the process.

Digitalisation in itself does not offer this as it is difficult to empathise with a machine about matters of health, but in the hands of a professional podiatrist it is a powerful tool that can leave patients with the sense of understanding the process they are going through and the reasons for treatment.

Scientific evidence is always
at the heart of Biomech Consulting's
decision-making processes:
all the materials we offer
are tested and analysed so
they may offer optimal results
in terms of pressure distribution,
cushioning,
impact absorption,
and balancing of moments.



MOST COMMONLY USED MATERIALS FOR MAKING ORTHOSES IN 2021



We believe new technology to be a driver of development and innovation. .

During our short business history we have developed our own **digital work flow**, from data collection to the production of custom insoles.

In this period of development we have had the chance to build a **data base solid enough** to endorse this system of working. In 2021, we produced over 15,000 pairs of foot orthoses, all fully custom-made after a biomechanical study and with a prescription from a healthcare professional.

Of all these orthoses, only 0.47% had to be modified to adapt better to the treatment of the patient. In other words, our system works, resulting in positive changes in patients at functional, biomechanical and resistance levels.


Continual training
is the cornerstone of all our innovations.

CHANGES IN THE SURFACE AND PROPERTIES OF INSOLES AND PLANTAR PRESSURES

Study carried out by Aranza Requena Martínez,
Director of Biomech Consulting,
Expert podiatrist in biomechanics and sports podiatry,
lecturer at Miguel Hernández University.

AIMS OF THE STUDY

Orthopaedic insoles are normally the treatment of choice when the foot is suffering from different mechanical pathologies.

Different variables that affect the right outcome of this treatment must be taken into consideration:

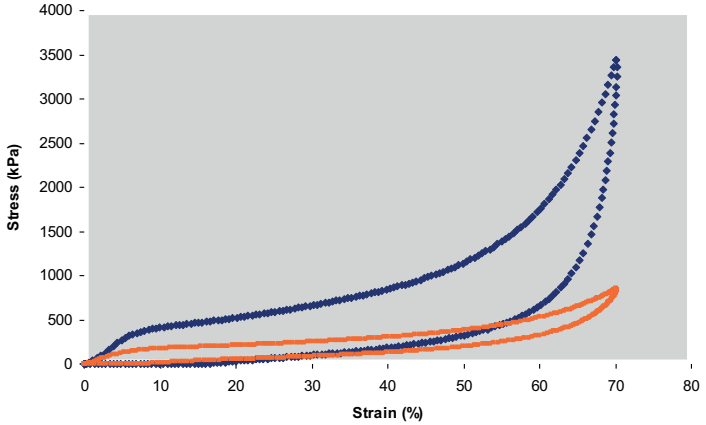
- Main and/or secondary pathology
- Patient's weight and activity level
- Material of choice for the insole
- Plantar pressures
- Patient kinetics and kinematics

This study aims to define the relationship between some of these variables: weight of the individual, their level of activity and the changes in **PLANTAR PRESSURES according to changes in the properties of the material after its use.**

Prescribing an insole may have several goals: relief from or absorption of impacts, and the right balance of foot moments[1].

However, one of the main functions is to produce the right distribution of plantar pressures with a little cushioning[2].

The materials used to achieve this must have relatively low stiffness[3] and be combined with good recovery, low compression and maintain their capacity to distribute forces over a prolonged period of use. The most widely used materials are closed-cell foams (EVA.



MATERIAL, METHOD AND RESULT

- 24 healthy subjects: 12 women // 12 men
- Mean age 36.4
- Mean weight 75.8
- Mean height 170.1

DIVIDED INTO 3 ACTIVITY GROUPS:

Low: Mainly seated, <750 min
Medium: 750 min > activity > 1200
High: Mainly standing or walking > 1200 min

TABLE OF RESULTS

RESULTADOS

	Forefoot (meta 1)	Midfoot (meta 2-3-4)	Heel
MCP	Status Status-activity-weiht	Status Weight Status-weight Status-activity	Status
MMP	Status	Status Weight Status-weight Status-activity	Status Weight Status-activity-weiht
IMP	Status	Status Weight Status-weight Activity-weight	Status Weight

GENERIC GEOMETRY INSOLES DESIGNED WITH CUSTOM 3D IN

- Used at least 8 hours a day for 10 days
- Same footwear (KELME-MICHELIN START-TREA 360o)
- RT3 activity monitor (Stay Healthy USA)
- Plantar pressures measurement with PEDAR system (Novel, Munich, Germany) operating at 50 HZ and measuring MCP, MMP and impulse
- Treadmill at 5 km/h for 3 min. Data collected for 60 seconds and taken 50 map.s-1
- Measurement of thickness in 3 defined areas every 2 days
- Post-processing of data and statistical analysis with PASW STATISTICS 18 SW (IBM Corporation, NY)

CONCLUSIONS AND BIBLIOGRAPHY

In a short-term real use scenario (10 days), the cumulative load using the thickness of 4 mm showed significant changes in the PLANTAR PRESSURE parameter, in particular in the forefoot (first metatarsal), due to the patient's weight and activity level (status) in line with the results from the tests for this material (dual density EVA, 50-30).

Consequently, weight, force and activity duration are variables that must be taken into consideration when deciding which materials to choose when designing insoles.

Further research is necessary to be able to predict the mean useful life of insoles according to the weight and level of activity of the patient, and to determine the ideal materials depending on the mechanical function required by the patients.

The changes observed over this short time period suggest that we must be careful when interpreting the effectiveness of insoles. The choice of material should be assessed in more depth.

1. Kirby K.A, 1989: Rotational equilibrium across the subtalar joint axis. Journal of the American Podiatric Medicl Association, 79(1):1-14.

2. Simon k. Spooner, S.K.; Kirby, K.A, 2010: in -Shoe Pressure Measurements and foot Orthosis. Journal of the American Podiatri Medical Association, 100: 518-529.

3. L.J. Gibson, M.F. Ahsby. Cellular Solids: Structure an Propieties, 2nd ed. Pergamon: Oxford, 1988.

4. R. Verdejo, N.J. Mills, 2004. Heel-Shoe interactions and the durability of EVA foam running shoe midsoles. Journal of Biomechanics, 37, 1379-1386.

5. J.G. Foto, C. Ped, J. A. Birke, 1998. Evaluation of multidensity Orthotic Materials used in Footwear for patients with Diabetes. Foot & Ankle International, 19 (12): 836-841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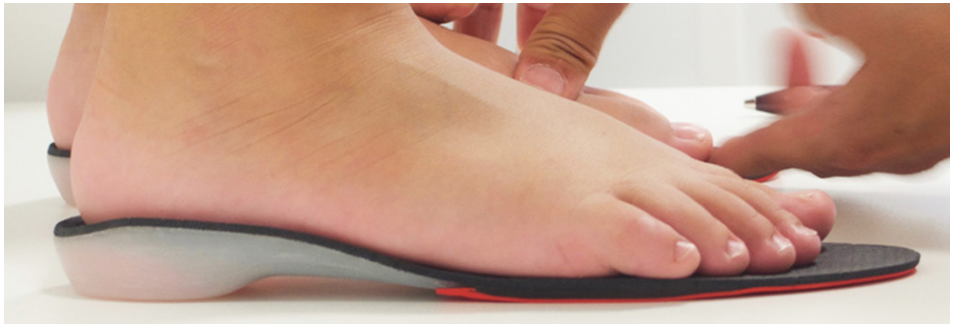
1.- NATURAL POLYPROPYLENE

Polypropylene (PP) is a thermoplastic polymer composed of a main chain of bonded carbon atoms from which groups of methyl (CH3-) hang that belong to the polyolefin group of polymers.

TECHNICAL FEATURES	COMMON USES
- Light - Washable - Quite elastic - Provides stability - Good biomechanical co-rrection - Good tensile strength - Resistant to breakage - High residual deformation - Impact resistant - Maximum constant working temperature 100°C	- Recommended in pathologies where significant biomechanical correction/compensation is required, such as paediatric pathologies when greater control and correction are required (paediatric flat feet)



2.- CARBON-FIBRE POLYPROPYLENE

It has the same composition as natural polypropylene; the master batch is based on a polyolefin support. It also contains carbon particles.

TECHNICAL FEATURES	COMMON USES
- Light - Elastic (more elastic than natural polypropylene) - Radiolucent - Good stability - Good biomechanical correction - Impact resistant - Good tensile strength - Good balance of stiffness, and abrasion and chemical resistance	- Recommended in cases where significant biomechanical correction is required with extra elasticity. For example, for athletes who need the control provided by plastic, but with good elasticity so as not to generate tissue stress.

3.- ETHYLENE-VINYL ACETATE (EVA). HARDNESS 30, 40, 50, 60, DOUBLE-HARDNESS AND TRIPLE-HARDNESS

This is a closed cell thermoplastic polymer consisting of repeating units of ethylene and vinyl acetate. It has a low weight. The range of hardnesses increases the options for its uses and applications.

TECHNICAL FEATURES	COMMON USES
- Very light - Washable - Low water absorption - Easy to cut and stick - Non-toxic - Good stability - Average biomechanical correction	The harder it is, the more mechanical support. If a low hardness is used, it provides more cushioning.

4.- POLYURETHANE

Polyurethane (PU) is a polymer obtained by the condensation of hydroxyl bases combined with diisocyanates. Depending on their chemical structure and how they behave in different temperatures, they can be thermostable polyurethanes or thermoplastic polyurethanes. The formula of PU depends on its end use, in this case: "polyurethane foam", whose formula is based on polyols combined with isocyanates. It is an open cell material.

Biomech Consulting is the first Spanish company to succeed in machining this material to obtain unique, fully customised insoles with unique features.

TECHNICAL FEATURES	COMMON USES
- Easily adaptable material - High capacity to absorb and cushion impacts - Low residual deformation - Maximum comfort - Maximum energy absorption - Optimal sweat management - Washable - Resistant to bacteria and fungus - Less biomechanical correction than other materials	Used in cases where distribution of plantar pressures is required. Its high cushioning capacity, among other features, makes it perfect for treating patients with diabetic foot and geriatric patients. Its corrective effect/mechanical strength is less than that of other materials.

1- E.VA.

As well as for manufacturing foot orthoses, it is used for both upper and lower linings of different thicknesses, either with microperforations or smooth. The purpose is the final covering of the insole. It comes in a wide range of colours, thicknesses and qualities for all these linings.

TECHNICAL FEATURES	COMMON USES
- Light - Elastic - Impact resistant - Good tensile strength - Good balance of stiffness, and abrasion and chemical resistance.	- The thicker it is, the greater the comfort. - EVA linings with microperforations increase breathability. - With polypropylene insoles, a bottom lining of EVA is recommended to grant them greater consistency.

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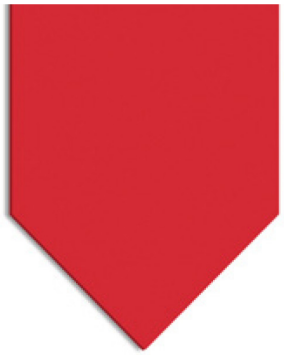
BASIC QUALITY / EVA

UPPER AND INTERMEDIATE LINING

RED smooth						
Thickness in millimetres	1	1,5	2	2,5	3	3,5
		●		●		●

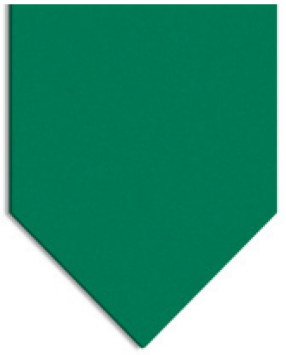


RED microperforations						
Thickness in millimetres	1	1,5	2	2,5	3	3,5
		●		●		●

BLUE smooth						
Thickness in millimetres	1	1,5	2	2,5	3	3,5
		●		●		●

BLUE microperforations						
Thickness in millimetres	1	1,5	2	2,5	3	3,5
		●		●		●

GREEN smooth						
Thickness in millimetres	1	1,5	2	2,5	3	3,5
		●		●		●

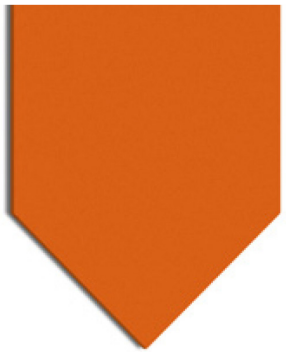


GREEN microperforations						
Thickness in millimetres	1	1,5	2	2,5	3	3,5
		●		●		●

VIOLET smooth						
Thickness in millimetres	1	1,5	2	2,5	3	3,5
		●		●		●

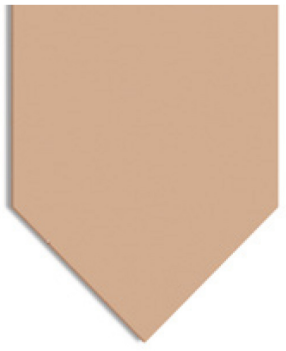
VIOLET microperforations						
Thickness in millimetres	1	1,5	2	2,5	3	3,5
		●		●		●

ORANGE smooth						
Thickness in millimetres	1	1,5	2	2,5	3	3,5
		●		●		●



ORANGE microperforations						
Thickness in millimetres	1	1,5	2	2,5	3	3,5
		●		●		●

SALMON smooth						
Thickness in millimetres	1	1,5	2	2,5	3	3,5
		●		●		●



SALMON microperforations						
Thickness in millimetres	1	1,5	2	2,5	3	3,5
		●		●		●

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BASIC QUALITY / EVA

UPPER AND INTERMEDIATE LINING

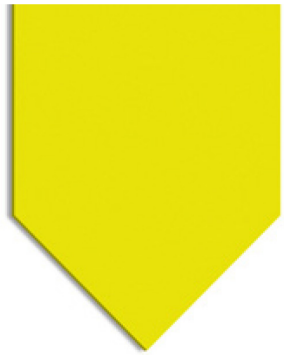
COCOA smooth	1	1,5	2	2,5	3	3,5
Thickness in millimetres		●		●		●

COCOA microperforations	1	1,5	2	2,5	3	3,5
Thickness in millimetres		●		●		●

BEIGE smooth	1	1,5	2	2,5	3	3,5
Thickness in millimetres		●		●		●

BEIGE microperforations	1	1,5	2	2,5	3	3,5
Thickness in millimetres		●		●		●

YELLOW smooth	1	1,5	2	2,5	3	3,5
Thickness in millimetres		●		●		●



YELLOW microperforations	1	1,5	2	2,5	3	3,5
Thickness in millimetres		●		●		●

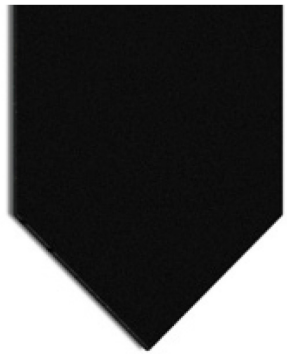
SKY BLUE smooth	1	1,5	2	2,5	3	3,5
Thickness in millimetres		●		●		●

SKY BLUE microperforations	1	1,5	2	2,5	3	3,5
Thickness in millimetres		●		●		●

PINK smooth	1	1,5	2	2,5	3	3,5
Thickness in millimetres		●		●		●

PINK microperforations	1	1,5	2	2,5	3	3,5
Thickness in millimetres		●		●		●

BLACK smooth	1	1,5	2	2,5	3	3,5
Thickness in millimetres		●		●		●



BLACK microperforations	1	1,5	2	2,5	3	3,5
Thickness in millimetres		●		●		●

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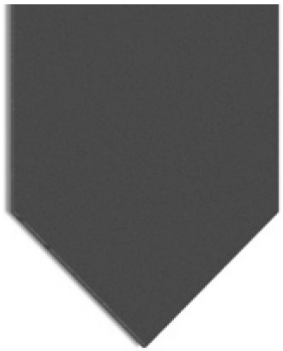
BASIC QUALITY / EVA

UPPER AND INTERMEDIATE LINING

GREY smooth						
Thickness in millimetres	1	1,5	2	2,5	3	3,5
		●		●		●



GREY microperforations						
Thickness in millimetres	1	1,5	2	2,5	3	3,5
		●		●		●

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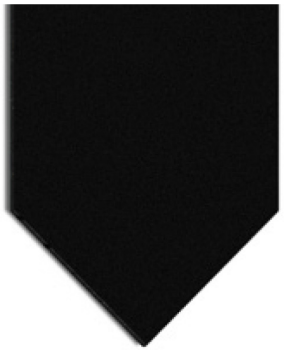
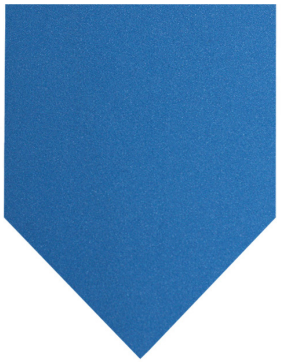
COMFORT QUALITY / EVA

UPPER AND INTERMEDIATE LINING

BLACK smooth						
Thickness in millimetres	1	1,5	2	2,5	3	3,5
				●		



BLUE smooth						
Thickness in millimetres	1	1,5	2	2,5	3	3,5
				●		



BEIGE smooth						
Thickness in millimetres	1	1,5	2	2,5	3	3,5
				●		

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SPORT QUALITY / LUNASOFT

UPPER AND INTERMEDIATE LINING

BLACK smooth						
Thickness in millimetres	1	1,5	2	2,5	3	3,5
			●			

BEIGE smooth						
Thickness in millimetres	1	1,5	2	2,5	3	3,5
			●			

RED smooth						
Thickness in millimetres	1	1,5	2	2,5	3	3,5
			●			

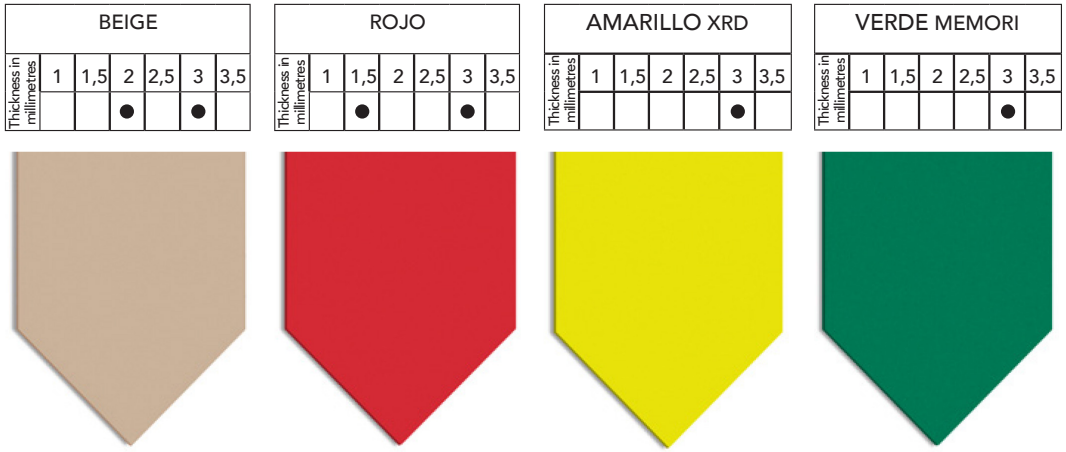
BLUE smooth						
Thickness in millimetres	1	1,5	2	2,5	3	3,5
			●			

PARCHIS OR TWO-TONE smooth						
Thickness in millimetres	1	1,5	2	2,5	3	3,5
			●			

2.- PORON

Poron is a polyurethane foam that is generally used for technical parts in specific areas of the insole.
The mechanical effect achieved (impact absorption, rebound effect, cushioning, etc.) depends on its hardness, resilience, etc.

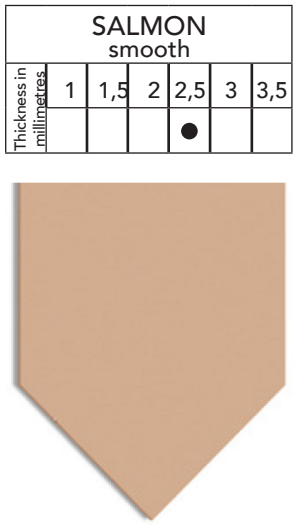
TECHNICAL FEATURES	COMMON USES
- Easily adapted - High capacity to absorb and cushion impacts - Low residual deformation - Maximum comfort - Maximum energy absorption - Optimal sweat management - Durability - Washable - Resistant to bacteria and fungus	- Used to obtain the highest levels of comfort. - It can also be used to obtain high levels of relief and cushioning, which is why it is used in additions. - It is always used for additions and upper lining but Poron must not be in **direct contact with the patient's skin so it must have another lining over it**. Friction can result in overheating.



3.- PLASTAZOTE

Plastazote is a very pure, reticulated polyurethane foam manufactured using a pressurised nitrogen injection technique (thermoplastics).

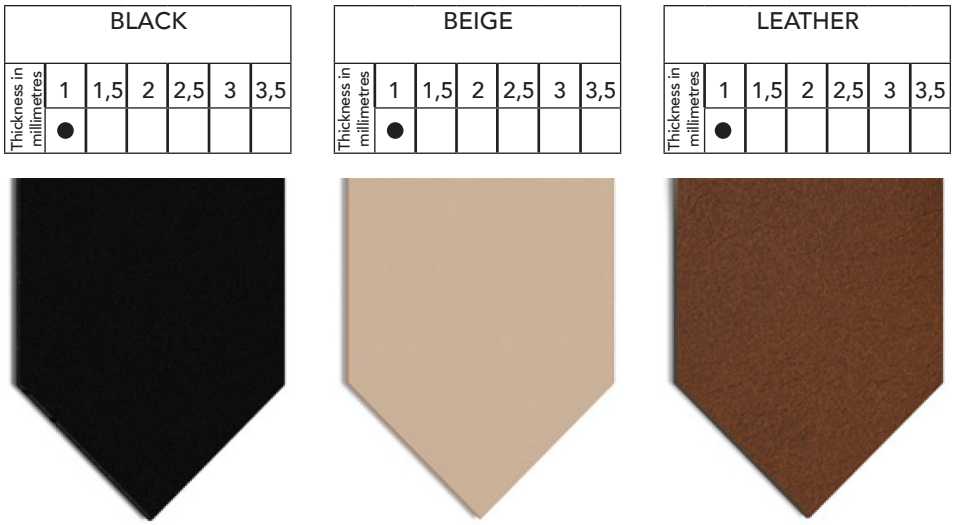
TECHNICAL FEATURES	COMMON USES
- Light - Washable - Good tensile strength - Resistant to breakage - Uses	Special material for people with or at risk of diabetic foot, or with ulcerated or deformed feet.



4.- ON STEAM

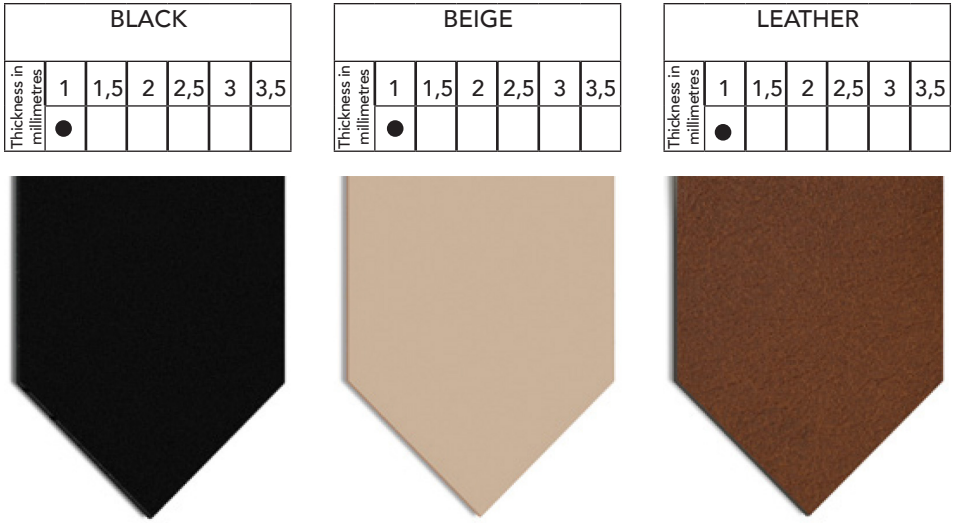
State-of-the-art material with a finish that is impeccable in terms of touch and quality.

TECHNICAL FEATURES	COMMON USES
- 100% microfibre product - Absorbent - Breathable - Anti-odour - Washable - Tear resistant - Low water vapour permeability - Abrasion resistant	Given its high level of breathability and anti-odour features, it is particularly recommended for patients performing physical activities or who sweat heavily.



5.- ON SUEDE

A versatile, soft, plush synthetic material.



6.- GRAPHITE

Graphite is a synthetic material used as a bottom lining.

CARACTERÍSTICAS TÉCNICAS	USOS HABITUALES
- Non-slip - Visual impact similar to carbon - Great finish and appearance quality - Greater durability	Due to its non-slip qualities, it is recommended for use in insoles for patients taking part in physical activity

SILVER						
Thickness in millimetres	1	1,5	2	2,5	3	3,5
	●					

If no two feet are the same,
two insoles shouldn’t be the same.

MAIN BENEFITS OF OUR FOOT ORTHOSES

The key element differentiating the custom insoles of Biomech Consulting from standard insoles is that they are produced from a 3D model of both feet.

Every patient is different and their two feet are not the same either. For data collection, we use the latest 3D scanning technology - the Biomech Scan 100 - developed by the Valencian Biomechanics Institute exclusively for Biomech Consulting.

When a foot clinic has a prescription and mould or scan corresponding to a patient's feet, it can work side by side with Biomech Consulting.

Worthwhile synergies can be developed since we boast a valuable team of experts in biomechanics, podology and podiatry, 3D design, numerical control machining and digital data collection.

Our B2B system is a way of offering patients excellent results by means of cooperation between the foot clinic treating the patient that elaborates the prescription and mould or scan and the Biomech Consulting team.

We develop the final product based on what the podiatrist says the patient requires, using machined materials finished to the highest quality.

At Biomech Consulting we also personalise the finishing materials as we have a wide range of colours and thicknesses.

Your feet support your body. And what's more, each foot has 26 bones, 36 joints and over 100 muscles, tendons and ligaments, not to mention 7,000 nerve endings.

Given their importance, it is necessary to make patients aware that using generic insoles without a medical prescription is not enough. In the case of sportsmen and women, using custom insoles prevents injuries, improves sports performance, provides more stability, reduces muscle fatigue, gives more cushioning and stops toe deformities, calluses and corns from developing.

Biomech Consulting makes the mechanical additions and corrections required for any kind of insole according to the pathology of the patient.

It is possible to combine up to three hardnesses in the same machined insole. In other words, we are able to give one single insole different levels of hardness.

Biomech Consulting guarantees the highest level of correction with a high Shore A EVA, but we also offer maximum comfort and plantar pressure distribution with another material, namely polyurethane.

It is worth highlighting that Biomech Consulting is also the pioneer in polyurethane machining. Our team is the first Spanish company to succeed in machining this material to obtain unique, fully customised insoles with unbeatable features.

A method of work based on technology and ongoing improvement allows us to have the control and the means to work with materials that best meet the needs of each specific case.

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