open the mouth, lower point of the corner teeth make zigzag movement. When patients opened the mouth at maximum (4 patients (36%)), they had pain attack increasing. It is determined by muscles tension increasing and could be considered as myalgia by Y.A.Petrossova, O.Y.Kalpakjantz, N.Y.Seferjan (1996) [6].

During the functional test (mastication test – patient was to bite the cotton swab) the pain attack increased for 5 patients.

All patients had dentition defects from I to IV classes by Kennedy. Teeth were also complicated by plural occlusive surface destruction, pathological dental abrasion, dental arches deformation, periodontitis. Inter-occlusive height reduces in 90% of cases.

Radiomethods of examination allowed to reveal articular head deformation and constriction of joint space of different intensity degree for patients. A part of patients (6 persons (55%)) had flattening of glenoid fossa and articular head what corresponds to the informations by V.N.Semkin, N.A.Rabuhin, A.M.Rassadin (1998) [9]. When the most of patients (8 persons (73%)) tried to open the mouth, articular heads were placed on the clivus of the articular tubercle of temporal bone or in front of it.

During patients orthopedic treatment underwent, we provided the following conditions:

1) maximal contact of dentition in the central occlusion;

2) plural contacts of dentition in the anterior and lateral occlusion;

3) free sliding of dentition when passing from one occlusion to other one;

4) restoration of the physiological occlusive height,

5) soft tissue injury of the oral cavity with teeth was excluded.

Pain in the region of temporomandibular joint of the face disappeared clinically, tension in the region of mastication muscle reduced, zig-zag movement of the lower intermaxillary point was corrected when patient tried to open the mouth. According to the radiomethods of examination, articular heads of the most of patients (6 persons (55%)) jointed the back clivus articular tubercle of temporal bone and was on the clivus of the articular tubercle of temporal bone (4 patients (36%)).

Conclusion

In order to remove the pain in the face region caused by functional changes of temporomandibular joint it is advisable to use treatment procedures obligatory combined with rational prosthesis which provides traumatic occlusion removal, plural balance contacts restoration of the lower and upper jaws and Dia-DENS therapy.

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THE USE OF NEW MATERIALS IN THE PRODUCTION OF SCOLIOSIS BRACES

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Abstract

Scoliosis is defined as a lateral curvature of the spine [1], the presence of which is abnormal. The term scoliosis is derived from the Greek word for curvature [2]. It can give the body a disfigured appearance because when the spine bends to the side, the vertebrae become twisted and pull the ribs round with them, which sometimes form a "hump" on the back and cause protrusion of the shoulder blade.

At present, there are two options in the treatment of scoliosis (bracing or surgery) [3]. The current practice to prevent curves from getting worse is to wear a brace. However, due to present materials and manufacturing methods, braces tend to be heavy and bulky and wearing a brace for a self-conscious teenager is not an easy treatment. This paper presents the main findings of research and analysis conducted on other materials which are potentially suitable for spinal brace production. It concludes that with the use of a new materials and manufacturing method the production of a more user-friendly brace is possible.

[Engineering of Biomaterials, 77-80, (2008), 3-5]

Background

The brace in most instances can not cure scoliosis. It can stop the curve from getting worse. The most commonly used brace is known as the Boston Brace. The Boston Brace is used for non operative treatment of idiopathic scoliosis [4]. Such a brace can be worn under the clothes. A typical brace is shown in FIGURE 1. Braces are normally worn 23.5 hours a day after preliminary period.

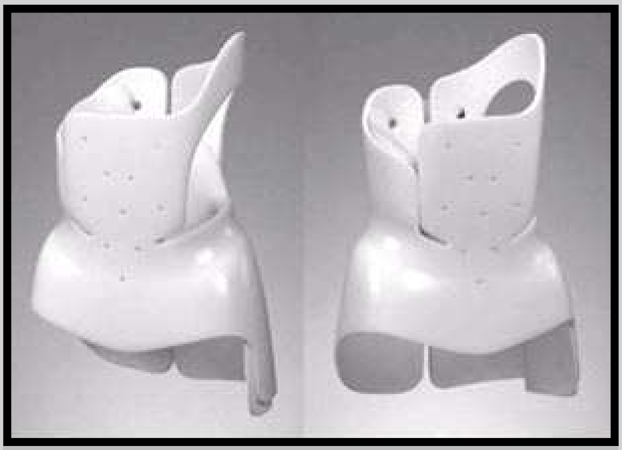

FIG. 1. Typical Boston Brace.

The Boston brace is made from polyolefin based materials, hard plastic co-polymer polypropylene outer shell together with polyethylene foam liner and correction pads located on the inner side of the brace. These materials have been used for brace production since the 1970's. The thickness of the polypropylene outer shell is approximately 4.5mm and the thickness of the liner is 4.5mm so the final product has total wall thickness of approximately 9 millimetres. The Boston Brace is manufactured in 30 stock sizes where all sizes are made from material of the same thickness. Each brace is finished from a module, similar to the one shown in FIGURE 2, by use of standard cutting tools. Different types of scoliosis braces can be achieved from one module. The final trim lines correspond to the X-ray picture of the patient's spine. Additional adjustments required during the fitting of the brace to the patient by the orthotist are usually made after the initial days of wearing the brace. Most common adjustment is to remove excessive material or thermally flare edges or deflect material on special locations on the brace to make it as comfortable as possible. The more the brace is worn the more effective it becomes in correcting the curve of the spine.

FIG. 2. Module.

Demands for a more user-friendly brace are very high. The main demands are for an overall thinner, lighter and more breathable brace. However, any new material must be in keeping with hypo-allergy and hygienic aspects for everyday use.

Methods

This study was performed on an evaluation of the current Boston Brace. The smallest stock size called J1 was used. The most important property of the brace is its ability to keep its shape when put on to the asymmetric patient's trunk. This means that the stiffness and brace design has to be kept at all stages.

From the Equation 1 describing equilibrium between Modulus of Elasticity E and Moment of Inertia I follows that reducing of the wall thickness has to be compensated by increasing of the modulus.

$$E \times I = const \qquad (Equation\ 1)$$

Reduction of the wall thickness should automatically lead to the reduction of the weight while using the same material. This is true only if the density of the material is same or lower than the original one. The group of materials which can offer significant increase in modulus of elasticity, reduction of wall thickness and possibly reduction of the weight at the same time with post-manufacture thermal adjustability is called thermoplastic composites, also denoted as thermoformable composites.

It is well known that composite materials can be customised to the level where required properties are met. To be able to do this, a proper analysis of the current product and material needs to be done. The same analysis follows for the suggested new thermoplastic composites and to this end the Finite Element Method (FEM) is a very suitable tool. To commence the analysis the following data were required:

1. 3D model of the product,
2. Mechanical properties of evaluated materials as:
a. Tensile modulus in longitudinal and transverse direction
b. Shear modulus in longitudinal and transverse direction
c. Poisson's ration in longitudinal and transverse direction
3. Loading cases.

A three dimensional model of the brace was gained from a CT (computerised tomography) scanner and transferred in to IGES (Initial Graphic Exchange Specification) file format readable in CAD (Computer-Aided Design) software, see FIGURE 3.

Mechanical properties of evaluated materials were obtained from material supplier and literature [5,6].

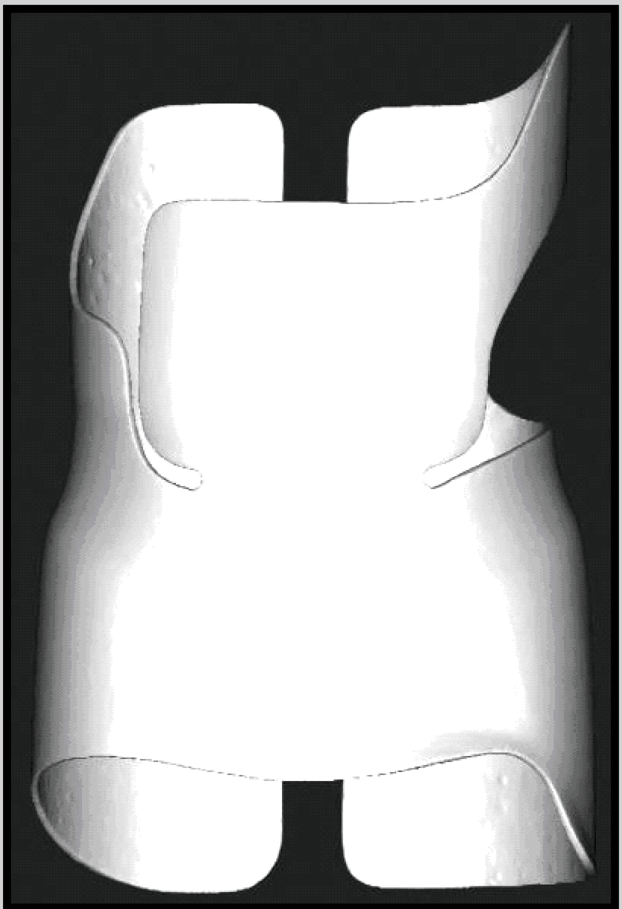

FIG. 3. 3D model of scanned brace.

Loading cases were considered for two conditions. Firstly, a simulation loading of when the brace is put on and taken off the patient's trunk. In this case the brace is loaded by bending in the horizontal direction. The second loading case simulated the internal pressure from an asymmetrical body shape for the interface between the body and the brace. Pressures are generally scattered on the overall torso. But pressures higher than threshold of 4.000 Pascal are on five distinct regions of the patient's trunk: right thoracic, left lumbar, abdominal, right and left side of the pelvis [7].

Suggested new materials are, as mentioned above, thermoplastic composites. In this case continuous fibre reinforced thermoplastic matrix. Regarding mechanical properties required for this application the dispersed phase is made from glass and carbon fibres. The chosen thermoplastic matrices had to correspond to the ones which are currently used and available in range of thermoplastic composites, to the range of required melting temperatures, stability and mechanical and physical properties. Thus the selected ones were polypropylene (PP), polyamide 6 (PA6) and polyamide 66 (PA66), see TABLE 1.

TABLE 1. Evaluated materials.

Material	Orientation
Co-polymer Polypropylene	-
Roving Glass 45% / PP	80:20
Roving Glass 45% / PA6	80:20
Carbon 45% / PA66	100:0

Results

The finite element analysis gave results of optimal wall thickness for these new composite materials. For the consideration of what material to use the density and consequently the weight of the particular composite has to be evaluated together with the economic aspect. It is well known that carbon composites are much more expensive than the glass composites but they can offer higher mechanical properties with higher weight reduction which results in a thinner material and therefore a thinner brace.

The manufacture of the brace from this new material requires a different processing method and the results of research carried out to date into a new manufacturing process is very encouraging. At the time of writing it is patent pending. However, the new process will make the production of the brace much less labour intensive.

Acknowledgements

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METHODS FOR FUNCTIONAL STATE EVALUATION OF THE III BRANCH OF TRIGEMINAL NERVE FOR RABBITS WITH ELECTROODONTOMETRY IN EXPERIMENT

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Introduction

Last decades, they observed permanent increase of traumatic injuries of peripheral branches of the trigeminal nerve due to: 1) facial bone fractures (93%), 2) iatrogenic injuries (7%) [1]. Neuroreflex disorders related to the trigeminal nerve branches injuries have the main role in the pathogenesis of the big part of complications in traumatic injuries and surgical operations of the facil bone [6]. Methods for evaluation of the functional state craniocerebral nerves: facial, glossopharyngeal, optic nerves [5, 8], are well described in the in the medical literature. But description of the available methods for objective evaluation of the functional state of trigeminal nerve system totally and its peripheral branches particularly in experiment and in clinic is not found. It is well known that passive electric properties of skin are determined by there morphological structure and depend on the functional state of the underlying tissues [7]. Before, for diagnostic purposes they used level changes and bilateral asymmetry indices of the skin potentials in projection of peripheral branched of trigeminal nerve outlet. Changes of the mentioned electrophysiological parameters show pathological process development when peripheral branches of the trigeminal nerve are damaged [3]. Taking into consideration that innervations of skin and mucous tunic of the under lip, mucus tunic of the alveolar appendix are provided by the inferior alveolar nerves, examination of electrosensitivity (ES) of soft tissues innervated with inferior alveolar nerves by application of the electric current as irritant, could be used as one of indices of its functional activity. The nature of the test consists of the skin nerves receptors irritation with electric current provided by an electroodontodiagnostics device when before-threshold (provided) sensation – pricking [4] is achieved by certain electric current. Our days, acupuncture is considered as physiological method correction of the disturbed functions [2]. But there is no information in the special medical literature about study of the functional state rehabilitation of the trigeminal nerve peripheral branches in traumatic injuries of the trigeminal nerve in different time of treatment when acupuncture applied as part of the complex treatment.

The aim of the work is to elaborate methods for the functional state evaluation of the injured inferior alveolar nerves in experiment and to study the process of the functional state of the inferior alveolar nerve restoration in experiment, to make comparative appreciation of restoration results for standard treatment and treatment combined with acupuncture.