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TEHNOLOGIA INOVATIVĂ

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CUPRINS

ABSTRACTS "INNOVATIVE TECHNOLOGY" 1 / 2014

MARKETING STRATEGIES TO INCREASE THE SALES IN A CAR SERVICE

Filip Ilie, Simina Bica

Polytechnic University of Bucharest, ROMANIA

In a market economy, any organization, especially an organization with purpose lucrative, conceives its own policy, which designates its future development directions and concrete ways of making its policy that we must ensure permanence market and especially the ensemble development. Base component of the policy of a company is marketing policy, which offers the possibility of prompt and real reception of the market signals and enable rapid adaptation to changes market, with maximum efficiency. Thus, the company can accurately assess, market parameters and allocate appropriate the resources adequately available, of real demand, may it refer uncovered segments on market and comparative advantages over competitors.

In the present conditions, no company can afford to operate without to have a clear, both short and long term, which its assure subsistence, but and rationality, efficiency given that the environment becomes more complex and dynamic. Compared to many changes that occur in both the microenvironment and the macroenvironment in which the company is present, must manifest a certain behavior, an certain attitude, which is reflected in the delineation of the strategic directions and of practical ways of making them, and it is reflect in the content of marketing policy of the company. In the activity of any organization choosing marketing strategy marks an important step, that completes stage in which is defined mission and the purposes pursued, on base a careful analysis and relevant of the his situation.

Marketing strategy designates the defining lines of the attitude and conduct company, to achieve certain objectives. It is the concrete objectives ensemble to be accomplished in - a period of time, of means and methods by which they translate into practice, expressing trends and demands to achieve the established performances, whose level is measured using the indicators economic, such as business volume, market share, profit etc. Thus, the purpose of this paper is to highlight the role of marketing strategy in achieving a company by auto service type, the application way of the marketing strategy, development, extension, concluding by partnerships and the increasing sales.

ASPECTS OF MEDIEVAL TECHNOLOGICAL PROGRESS, DUE TO CISTERCIAN ORDER, IN THE REGION OF NOWADAYS ROMANIA

Ciornei Florina Carmen, Alaci Stelian

'Stefan cel Mare"University,
Faculty of Mechanical Engineering,
Mechatronics and Management, Suceava,
ROMANIA

The paper is a brief presentation of the history, spreading and influences exercised by Cistercian order in the territory of nowadays Romania. The white monks had a significant contribution to medieval innovation and technology especially in water powered devices, but also in agriculture, metallurgy, wool industry and books production. The Abbey from Cârța followed the same principles and brought technological knowledge to the laic communities from nearby regions.

MICROSCOPIC MORPHOLOGICAL STUDY OF THE SUPERFICIAL VENOUS SYSTEM AND PERFORATING VEINS

Alaa Hadi Kerim, Ioan Bruckner

Faculty of Medicine, University of Medicine and Pharmacy "Carol Davila", Bucuresti, ROMANIA

The pathogenic mechanism of varicose veins should be seen whole, in all its complexity, as a result of the numerous links, the pathogenic lesion causing morphological substrate specific functional disorders, translated by clinical symptoms.

ULTRASTRUCTURAL MORPHOLOGIC STUDY OF THE SUPERFICIAL VEIN SYSTEM

Alaa Hadi Kerim, Ioan Bruckner

Faculty of Medicine, University of Medicine and Pharmacy "Carol Davila", Bucuresti, ROMANIA

Morphological substrate research of varicose veins benefited unquestionably the possibility of penetration at the ultrastructural level by electron microscopic investigation. Analysis of the lesions indicates a ultrastructural profile installed when triggering pathogenic, adding to the personal results supporting the existence of morphological changes even non varicose clinical territories.

HVOF APPLICATIONS - STATE OF ART

V. Avramescu, L. Paun, R. Nita, S. Rosulescu, D. Bobe

Mechanical Engineering and Research Institute, Bucharest, ROMANIA,

This paper presents briefly, the thermal spraying process at high speed by accelerating powders /particles using the forced combustion of oxygen - HVOF process. Also, there are presented some HVOF coating methods specific to medical area and also, some material that are used for these applications.

THEORETICAL DETERMINATION OF TECHNOLOGICAL PARAMETERS SPECIFIC TO HVOF PROCESS

V. Avramescu, R. Nita, L. Paun, S. Rosulescu, D. Bobe

Mechanical Engineering and Research Institute, Bucharest. ROMANIA

Article aims to estimate the limits of technological parameters in HVOF thermal spraying for practical applications, from theoretical studies and using data from specialized literature and from experience. The paper specifies about HVOF metallization powders used for each case that is analyzed.

MARKETING STRATEGIES TO INCREASE THE SALES IN A CAR SERVICE

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ABSTRACT
In a market economy, any organization, especially an organization with purpose lucrative, conceives its own policy, which designates its future development directions and concrete ways of making its policy that we must ensure permanence market and especially the ensemble development. Base component of the policy of a company is marketing policy, which offers the possibility of prompt and real reception of the market signals and enable rapid adaptation to changes market, with maximum efficiency. Thus, the company can accurately assess, market parameters and allocate appropriate the resources adequately available, of real demand, may it refer uncovered segments on market and comparative advantages over competitors.
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KEYWORDS: marketing strategy, marketing policy, strategic directions and practical ways

1. INTRODUCTION

Marketing concept emerged in the last decades of the last century,today is considered the essential factor of success of an organization , the process of identifying, anticipating and satisfying customer requirements profitably to both parties.

After ref. [1] "Marketing is a social and managerial process by which individuals or group of individuals get what they need and want through creating, offering and exchanging products and services with a certain value".

The definition shows that "profit" is not strictly regarded accounting, but designates the benefits, satisfaction of both parties (customer and organization). Definition of marketing concept tempted and tempts many specialists and different specialized institutions. According to the American Marketing Association, the marketing is a set of activities through which "it directs the flow of goods and services from producer to final consumer"[1].

Marketing strategies can be of three types: defensive, development and offensive. Defensive strategy - is designed to prevent the loss of existing customers.

This strategic alternative takes into account the weaknesses of SWOT analysis and builds the strategy, taking account of these.

Typical defensive strategies could be:

- improve company image;
- improving the quality / safety of products / services;
- improve safety supplies;
- improving the presentation style / packaging of the product / service;
- improve product performances;
- improving durability of product;
- eliminating errors of the product.

Development strategies - are used to give existing customers a wider range of products and services. Typical development strategies are:

- increase the range of the sizes/colors/ materials offered;
- increasing the range of services offered;
- increasing the range of options and features;
- discovery of some new uses of the product;
- developing a new product;
- improve of the product in terms of environmental protection.

Typical offensive strategies are:

- changing pricing policy;
- use of new distribution channels;
- finding new outlets;
- entering new geographic markets;
- entering on new industry sectors.

Philip Kotler in ref. [2] shows that the marketing means to act on market using means and shares to estimate as real, potential exchanges to satisfy human needs and desires. So, marketing is human activity directed to satisfying needs and desires, through exchange processes [2].

2. ROLE OF MARKETING STRATEGY IN ACHIEVING COMPANY OBJECTIVES

In the activity of any organization choosing marketing strategy marks an important step, that completed stage, in wich the defined the mission and the purposes pursued, on based a careful analysis and relevant its situation.

Marketing Strategy designates the defining lines of the attitude and behavior of the organization in order to achieve certain objectives. It is represented by all concrete objectives to be accomplished over a period of time, means and methods by which they transpose in practical, expressing the trends and requirements, that are imposed to achieving the set performances, whose level is measured using some indicators economic, such as: activity volume , market share, profit, etc. [3].

Develop marketing strategy involves the following steps:

1. analysis of the internal environmental the company's (diagnos);
2. analysis of the external environment;
3. formulating marketing objectives;
4. analysis and selection of target markets;
5. marketing strategy formulation;
6. marketing plans and programs;
7. implementation of marketing plans and programs;
8. control and evaluation of results.

The marketing strategy adopted by a company for a certain period is the result of the combination of experience, intuition and hope marketing managers, science and art which they possess, is the result of the compromise confrontation, negotiations and consensus. Typically, companies develop long-term strategies, medium and short with objectives clear, concrete, precise, lifelike, that it detailing by the appropriate tactics. In this way, companies respond both the immediate demands of changes in the ambient environment, and framing in a long-term behavior, which allows a unified vision, coherent and perspective.

The role of marketing strategy is manifested by effective use of the marketing mix, defined as "the ensemble of controllable tools of the marketing tactics - product, price, placement and promotion - of which it serves society to produce the answer you want from the part the target market." Thus, product policy defines approach of the companies on the sizes, structure and dynamics of the mix of products and services in relation to environmental requirements, market characteristics, consumer needs and desires, etc. respectively take into account and from the internal conditions.

Product policy is "the central component of marketing, because the product is the most important element of the marketing mix ". Product mix includes ensemble of products manufactured and/or marketed by a company, and the relationships between them.

Policy price - price is "a sum of money that the buyer a accepts and is willing to a pay the seller in exchange of the product or service purchased."

According to another approach, the price is "the result of the evaluation of the products and services available on the a given market in order to meet the interests of participants in the exchange process [4].

Price mix includes all categories of prices charged by a company, and the relations between these. In reality, companies define their and follow different pricing strategies. As a result, categories of pricing charged by a company derives from strategy adopted or pricing strategies adopted.

Promotion Policy - communication policy of a company is an important element of marketing actions, an essential variable of the marketing mix.

To sell is not enough to provide a product at a certain price, through distribution channels. This offer must be accompanied by a ensamble of coherent communications, having aimed presentation and product positioning, awakening attention and interest of consumers, and creating and maintaining a favorable image.

Choosing communicational mix is one of the hardest, but and beautiful the communication policy decisions at the company level.

The literature identifies two main strategies that can be adopted in the communication process, namely: the strategy of "push" strategy "pull".

Distribution policy has the primary role of distribution "by to approach and adjust the supply and demand conditions in which each of the partners to gain an advantage." The importance of this element of the marketing mix is apparent in the assertion that a product which satisfies the requirements of the market, whose quality/price report is good and which is known and expected by potential consumers, can not sell if it is not present on the market [5].

3. MARKETING PLAN

The marketing plan is the guide step by step on way business success. The marketing plan constitutes the means by implementation of the marketing strategy, chosen and must be based on a clear understanding of marketing objectives of the company, of what is desired, to be carried out in the future, with the business in cause [6, 7].

The objectives of the marketing plan is a reflection of the overall mission and general objectives of the company, at the marketing function level. It is necessary that each goal be established in full compliance with the key issues highlighted by the SWOT analysis.

The marketing plan is designed by the marketing department using the information other departments, guided after specific objectives of the company and its mission, and includes the following sections: summary, activity area and description of the market, marketing audit, competition, SWOT analysis, objectives marketing, marketing strategies, marketing program, marketing budget, marketing plan implementation, control and its adaptation, as well as the appendices.

SWOT analysis (acronym composed of: (S) "Strengths" - strengths, (W) "Weaknesses" - weaknesses, (A) "Opportunities" - opportunities and (T) "threats" - threats) aims to highlight issues linked by the company's internal and external environment in which it operates [8, 9].

SWOT analysis can be useful whenever the manager achieves an analysis or an activity planning.

Also, can be component of the preparation of the team conferences, of the resources annual evaluation of performance or meetings fixing of plan targets.

Periodically the company should be subject of a diagnostic analysis, to assess strengths and weaknesses and to establish on this basis, whether it has the necessary skills to take advantage of opportunities. In this regard, the management company or an external consultant assesses company competencies regarding the following activities: marketing, research and development, production (workforce, production capacity etc.), human resources, procurement (material resources), accountancy (financial resources).

Based on the principle of substitution, the method assumes that an informed buyer would not pay more to a good than the cost of to purchase a good comparable with the same utility. In principle the comparison can be applied and in the evaluation of companies closed, the premise being that the market multipliers can be used to evaluate the companies unrated.

4. INDICATORS AND TECHNICAL-ECONOMIC INDICES

These indicators is can be calculated either at the firm level or at the level of responsibility centers. The importance of calculating economic-financial indicators is to know their evolution and their comparison with those of financial exercises earlier.

Economic indicators represent the qualitative and quantitative expression of results and economic activities and are:

- Turnover - is an indicator that measures the results at the microeconomic level, representing the volume of collections from own activity in a period of time and carried at the market price;
- Incomes are increases in economic benefits recorded during the accounting exercise as inputs or increases in assets or decrease in liabilities;
- Expenses of the operations related to the principal activity or operating. In this category we have: spending on stocks, costs with services executed by third parties; personnel expenses, costs with other taxes and similar payments, other operating expenses. Total expenditures represent the ensemble of cash expenditures, regardless of destination;
- Gross profit represents the total income of a company after what was low the cost of goods sold. Gross profit does not include revenues obtained the accidental;

- Net profit is, generally, the amount that remains after all expenses have been covered. If of a company, is the difference between total sales ,costs and total expenses.
- Operating income is income derived by a company in the course of its work; they are called and income from core business. In addition to operating income, a company can obtain financial income and extraordinary income;
- Operating expenses represent the reflection in the accounting of the costs recorded by the company as a result of carrying out activities according its object by activity;
- Financial revenues are revenues recorded in the income and loss statement, that including: income from participations, other immobilizations and immobilized receivables, ie the dividends receivable to the participations at capital of other companies and other immobilized titles and interest on term for immobilized receivables;
- Other financial income relates to discounts obtained from suppliers and other creditors, and other financial income than those mentioned above;
- Financial expenses refer to those expenses incurred by a company in connection with financing decisions, investment decisions, exposure to exchange rate fluctuations or supply;
- Income tax payable represents the difference between the tax calculated from the beginning of the fiscal year to the end of the reporting period and tax on revenues the micro enterprises payable during that year [10].

5. APPLYING MARKETING STRATEGIES TO A AUTO SERVICE

Service Auto factored into the analysis, was established in 1999 as a private limited company with private capital, having as the first activity object, the wheels service, located on a mature market; the companies already established, suspecting the future potential of the company.

The company managed to stand fast on the Romanian market by rims and tires auto and services in this area, due to the high degree of professionalism of the staff and the outstanding quality of products/services. After an entire development process, due to company's management ambition, 2003 year was a landmark, the company signing partnerships for the import by premium brands and budget with the largest European distributors.

In 2004, was opened the division by alloy rims, through partnerships with various prestigious European suppliers. Since 2008, appears the distribution department, addressed retail stores in the field, and in 2010, was created a new point of retail. Further, the company is undergoing a complete transformation and radical, by building new warehouses, arranging their own office buildings at high standards, implementation of ERP software, and computerization of the entire society with the latest solutions and purchasing of a impressive auto fleet.

Year 2011 starts with signing an exclusiveness partnership with international manufacturer Nankang tires (Taiwan) and ends with a particular presence in the frame the Bucharest International Auto Show - 2011 edition.

Also in 2011 he sought new partners for alloy rims segment and to obtain exclusiveness from manufacturer Arcasting (Italy) and brought a doubling of their storage capacity and logistics company.

In 2012, despite the effects of the crisis, the company became the market leader for brands of the groups Michelin and Goodyear & Dunlop, is signed the exclusiveness with manufacturers of rims Keskin Tuning & Mam, League Wheels, RVs Wheels (for brands Avus, Forme and RVS), but the more importantly, obtained the authorization by official distributor of the BBS rims [11, 12].

Now, the company has as main activity field: "Trade with parts and accessories for motor vehicles" and the main business "Wholesale of parts and accessories for motor vehicles", but and secondary activities: maintenance and repair of motor vehicles, the recovery of recyclable materials sorted, retail trade of spare parts and accessories for motor vehicles, retail trade via mail order houses or via Internet.

The object activity of the company is not limiting, can be extended by the decision of the General Meeting of Shareholders (GMS) and with obtaining the legal advice.

The company will may done investment in any activity field, through participation, as a shareholder or associate, at the establishment or social capital of other companies, in joint ventures, regardless of their scope of activity, located in the country or abroad, as well at any other investment, based on the judgment of the GMS and in compliance with Romanian law in force.

The company is led and managed with full powers of representation and decision by two associates. Each of the associates holds an equal number of shares (representing 50% of the share capital of the company). Each of the administrators can represent the company with full powers, separate from each other. Management body of the company is the GMS, whose functions are those provided by law in force.

The share capital may be reduced or increased based on the judgment of the GMS and with the procedure compliance laid down by law.
The subscribed capital gives right members to achieve benefits under the provisions of this act of incorporation and the legal provisions in force.

Partial or total transfer of capital between partners and third parties is subject to conditions and procedure laid down by lege.

Rights and obligations relating to shares exchanged together with the shares.

The human resource represents all employees of the company, expressed through the same quantitative and qualitative indicators.

Thus, we can say that human resource is a resource very special, made up of people - employees, who generating the production factor - labor.

For example, human resource development for 3 years, is shown in Figure 1.

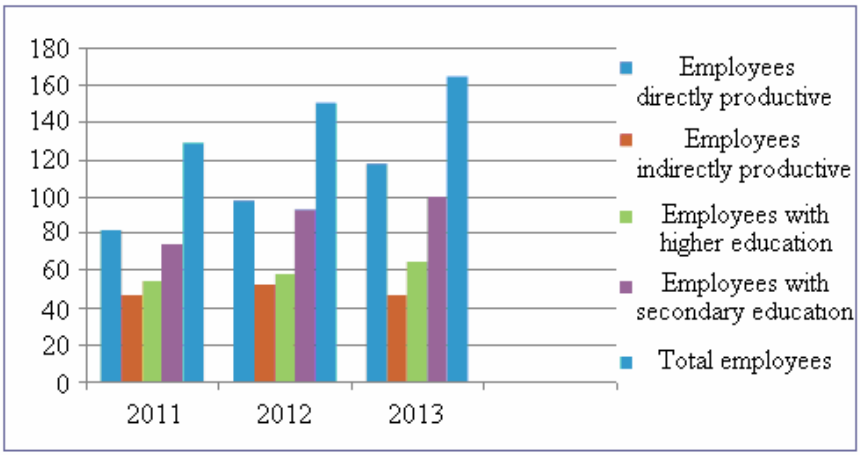

***Figure 1**. Human resource evolution for 3 years*

It is noted that in 2011-2013 the number of staff at the auto service increased, the same can be said and about the staff directly productive, those with higher education and those with secondary education and in 2013 one can observe a small decrease of the staff indirectly productive.

From a technical stand point, the company is adequately equipped of the its profile of activity, namely: technical means, deposits, means of conveyance, capabilities needed to produce utilities (boiler, air compressor), technical equipment needed for the activity ancillary services, respectively service, vulcanization.

The company uses appropriate technology to achieve high productivity and outstanding quality in execution, with advanced technology.

The entire range of equipment, which performs the necessary processes and operations, is continuously maintained, so the qualitative parameters it remains constant.

Thus, the company is equipped with machinery that enables the achievement in better conditions, of some service work, for total customer satisfaction. Also, the company has various tools required for operation under optimum conditions.

Particular attention was given to recruitment and qualification of workforce, so that they can serve with maximum efficiency of equipment from endowment and to ensure the quality level of the each works that he performs.

6. COMPANY ORGANIZATION

Organizational structure is considered as being "anatomy of an organization" providing a framework for society to function in conditions optimal [13]. Therefore attention is focused on the differentiation posts and the departments, formulation of some rules and procedures.

Organizational structure on that applies in managers practice, is actually the formal organization. It can be shown through of a diagram called organigram, showing various components of its (postures and compartments) with the formal relations established between them. With its help, it can distinguish the following issues:

- division of labour is how the activities from the frame of organization are distributed among its individual members and between the staff groups;
- subordination relations between positions and compartments are highlighted among the organigram lines, such it forming communication channels;

- chain of authority includes the successive layers of positions and departments, connected by command-subordination relationships.

A corporation is a legally constituted human community to cooperate to achieve jointly of some products, services or works to be sold at a price which to cover and to bring profit.

Organigram is scheme of the organization way of a company (see Figure 2).

Organigram contains posts, departments and hierarchical human relations (subordination, coordination) and functional.

Management can watch permanent key posts on that it can base, can make projections on the human resources, employees can know the place in the organization, and potential employees can view different paths for professional development.

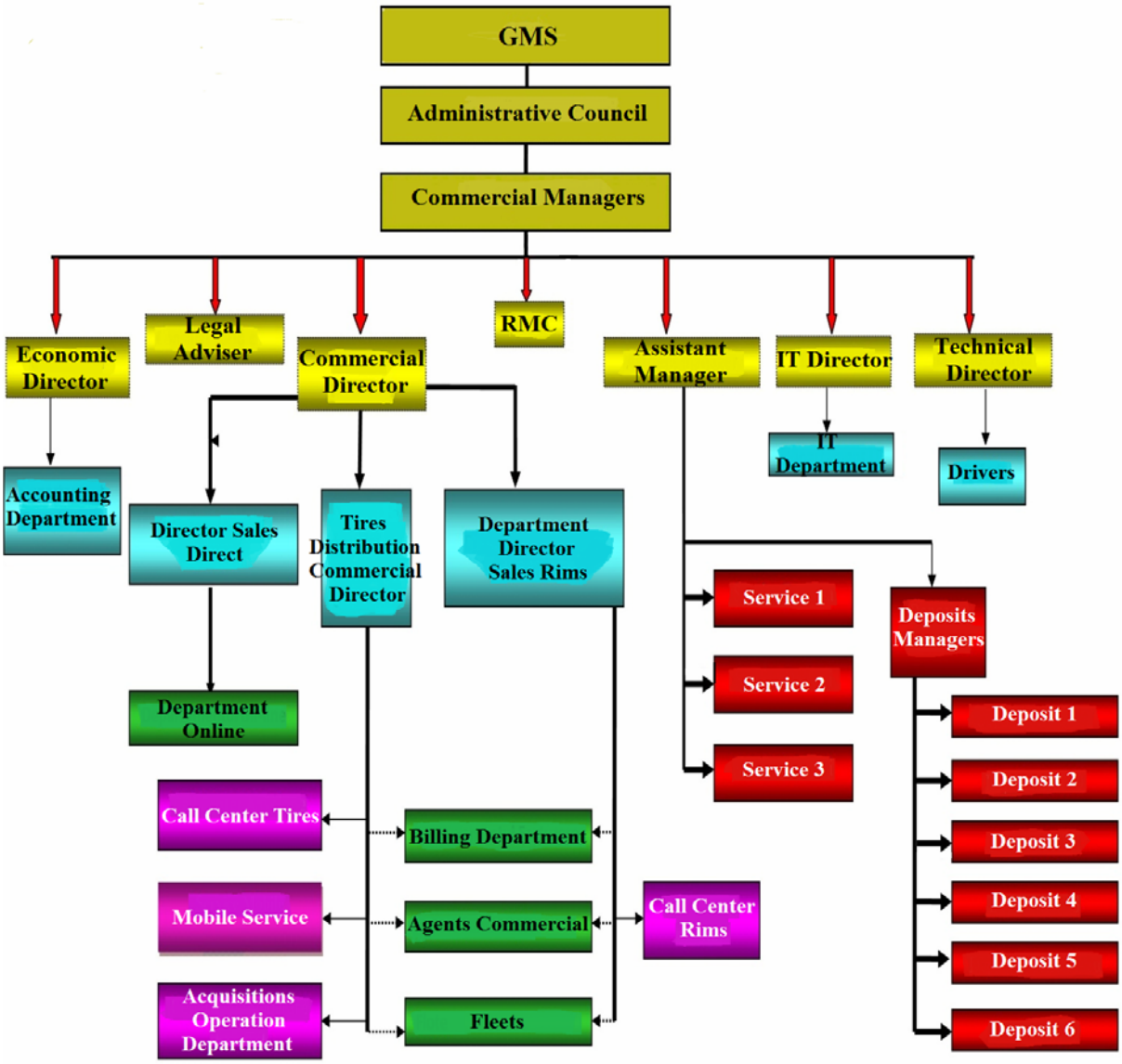

Figure 2. *General organigram of the auto service*

7. CONCLUSIONS AND RECOMMENDATIONS

- The company has progressed from the beginning until now and got to hold one of the most important places on the market in the auto service field, due to multiple products and services marketed, being one of the main importers of the rims marks and tire .
- Auto service is characterized by the importation of products of high quality, brands recognized on the international market.
- The company is facing a personnel fluctuation, mean age being 30 years, due to salaries offered the entry-level posts, therefore employees do not stay in company very long and do not acquire sufficient knowledge.
- The quality/price report is one balanced in the conditions of competition of some companies that have the same profile.
- The company has developed a own fleet of cars required effective distribution of products to the entire chain of auto service.
- Delivery of the products purchased at home without paying the cost of transport is an advantage offered customers.
- Virtual stores are a new way of acquisition the desired product by buyer, simple and efficiently with pay at destination or by card online.

As recommendations is can enumerate:

- Improve service quality offered through achieving of some employee appropriate trainings.
- Communication with own employees and motivating them by increasing wages and offering bonuses.
- Optimization of time by resolving customer complaints.
- Have sufficient and well-trained staff in the marketing department.
- Maintain of prices at the same level with competition because some similar products can be purchased from another company competing at a convenient price to the customer.
- Follow-up to cover in the particular way of the areas, where the service is not present either directly or indirectly (through the distribution network).
- Several contracts with dealers cars.
- Advertising campaigns creation for products that are enough in stock.
- All these marketing policies must be judiciously harnessed, so that grow consumer satisfaction in the conditions achieve maximum economic efficiency of the company.
- Better capacity to prospect of market, to have several sources of informations.

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Quick Info

Brokerage event at Hannover Messe, 9-10 April 2014, Hannover, Germany
This is the world's leading industrial trade show.
Almost **150 companies, 200 businessmen &-women** from 26 countries participated in the brokerage event in 2013. **1,250 meetings** were organised.
The brokerage event of 2014 at a glance:
• Two days individual intensive **business meetings** in an exclusive atmosphere
• A **complete hall** in the centre of the trade fair dedicated to business matchmaking
• **VIP lounge** at the disposal of the participants; **Festive evening** event with "Live Music"
• Broad international **partner network;** Professional **assistance** on the spot.

The brokerage event will
cover **all sectors** of
Hannover Messe, including:
• Industrial Automation
• Energy
• MobiliTec
• Digital Factory
• Industrial Supply

Exclusive business meetings
in the heart of the trade fair

MATCHMAKING EVENT AT A GLANCE

- Two days of **business meetings**
- A matchmaking area **in the centre of the trade fair**
- **VIP lounge** at the disposal of the participants

Festive evening event with "Live Music"
Broad international **partner network**
Professional assistance on the spot.
Dates: 9th - 10th April 2014

The **matchmaking event** will take place during **HANNOVER MESSE**, the world´s leading industrial and technological trade show.

Visits:6691
Clicks :18199
Catalogue views :1801
Profile views :604

Companies :54
Participants :65

Booked meetings :76

Countries :23
Sectors of activity :18

Number of Partners :57

THE B2FAIR CONCEPT

The uniqueness of the b2*fair* – Business to Fairs® concept will present companies with prospects to access new markets, establish enduring business relationships, and share their professional experiences on an international level. At present, b2*fair* has become a renowned and powerful measure with the scope to support businesses in their internationalisation process and to help them to form new potential partnerships in foreign markets worldwide.

The b2*fair* ideology is extremely relevant with the trend of increasing globalisation and competition. The b2*fair* coordination team organises matchmaking events all through the year to provide assistance to organisations in **exploring new business opportunities and finding desired partners especially in the current rapidly changing economic environment**. This renowned international concept is based on the amalgamation of two important market development tools which are essential to the expansion of companies aspiring to explore global market scales.
An interesting combination between international trade fairs and interactive matchmaking processes gives b2*fair* the advantage of presenting companies with a platform abounding with opportunities for businesses aiming at extending their business relations.

The success behind the b2*fair* concept is its ability to provide **high quality business meetings that can be carefully arranged in advance**according to the specific interests and concerns from participating companies and organisations coming from all over the world.
Thanks to the b2*fair* matchmaking event, European and international companies will have the opportunity to network with a significant number of potential business partners. The b2*fair* business exchange platform makes all this possible **with a minimum investment in time and money**. After the completion of the online registration, the cooperation profile will be accessible to all the registered companies participating in the event. After carefully studying the cooperation profiles, participants can book business dialogues with new/potential clients, suppliers or business partners they desire to meet with.
A few days prior to the event, every participating company will receive its provisional appointment schedule according to the expressed wishes and concerns in order to help the participants capitalise and take maximum advantage of their business trip and participation in the Hannover Messe trade fair.

TECHNOLOGY COOPERATION DAYS 2014

We would also like to draw your attention to the **"Technology Cooperation Days 2014"** organised by our colleagues of the Enterprise Europe Network – Niedersachsen / NBank.

While our matchmaking has a more general and horizontal approach, the "Technology Cooperation Days" focus on technologies, solutions, standards and references for industrial measurement processes as well as industrial manufacturing, which includes:

- Measurement Tools as Acoustic Technology, Analyses/Test Facilities and Methods, Chemical material testing, Electrical Technology, Mechanical Technology, Optical material testing, Optical Technology, Non Destructive Testing, Sensor Technology and Thermal material testing
- Amplifier, A/D Transducer
- Electronic measurement systems
- Recording Devices
- Reference Materials
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ASPECTS OF MEDIEVAL TECHNOLOGICAL PROGRESS, DUE TO CISTERCIAN ORDER, IN THE REGION OF NOWADAYS ROMANIA

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REZUMAT: *Lucrarea prezintă pe scurt istoricul, răspândirea şi influenţele exercitate de ordinal călugărilor cistercieni pe teritoriul actual al României. Călugării albi au avut o contribuţie semnificativă în inovare şi tehnologie în evul mediu şi mai ales în echipamentele acţionate de apă, dar şi în agricultură, metalurgie, industria lânii şi producţia de cărţi. Mănăstirea de la Cârţa a urmat aceleaşi principii şi a furnizat cunoştinţe tehnologice şi comunităţii laice din regiunile învecinate.*

ABSTRACT: *The paper is a brief presentation of the history, spreading and influences exercised by Cistercian order in the territory of nowadays Romania. The white monks had a significant contribution to medieval innovation and technology especially in water powered devices, but also in agriculture, metallurgy, wool industry and books production. The Abbey from Cârţa followed the same principles and brought technological knowledge to the laic communities from nearby regions.*

KEYWORDS: Cistercian monks, innovation spreading, water management

CUVINTE CHEIE: Călugări cistercieni, răspândirea inovaţiilor, managementul apei

1. INTRODUCTION

The Cistercians monks are known as literally hard working and for introducing major innovations, including new agricultural practices and the water mill.

The management of the Cistercian Order was innovative and very well-organized. All of the abbeys were centralized arranged, with a presiding abbey over a widespread group of daughter houses.

The organization of the Cistercian Order was avant-garde and had a deep impact on the management of other religious orders or laic activities. They spread both in space and time the cutting edge technologies from the medieval factories and farms owned by their monasteries, [1], [2].

Their presence in Transylvania is brought into attention from the point of view of supporting and spreading medieval technological advances.

2. HISTORY AND SPREADING

In 1098 a group of 21 monks left their abbey of Molesme in Burgundy and followed Robert of Molesme to establish a new monastery in which monks could carry out their lives in austere ceremony of the Rule of Saint Benedict. They obtained a swamp land called Cîteaux, in Latin, "Cistercium" and founded their new monastery where the community obeyed the original Benedictine ideal of work and prayer, charity and self sustenance, [1]. Later, they obtained a donation of a vineyard as well as stones with which they built their church, finished in 1106.

The abbot Stephen Harding is responsible for moving the order into its decisive stage, as he created the Cistercian constitution, Carta Caritatis and acquired farms to ensure its survival and moral code. He handed over the west wing of the monastery to a large group of lay brothers to cultivate the farms.

In 1111, twelve monks started a daughter house, and soon, other daughter abbeys: Pontigny, Clairvaux - founded by Saint Bernard of Clairvaux, Morimond Preuilly, La Cour-Dieu, Bouras, Cadouin and Fontenay, were also established. The principle was that each abbey was autonomous and isolated, but Cîteaux should always be the model to which all the other daughter houses had to conform and met yearly at Cîteaux, the president of the order.

By the end of the twelfth century the Cistercian houses were about 500; in the 13-th century a hundred more were founded and in the 15-th century, the order would be on 742 houses, all over Europe, Fig. 1.

To make time for work, they reduced the divine office. Despite distance and differentiation, all the monasteries communicated closely, [2]. Each abbey had certain autonomy, but uniformity and unity were strictly controlled.

Figure 1. *Daughter houses of daughter houses of Citeaux, [3]*

The most remote Eastern Europe abbey, daughter of Pontigny, was Igriş, in Timiş County at present, founded in 1179, by Ana de Chatillon, the first wife of Hungarian king Béla the III-rd, [4]. The monks were from France and here was established the first library on the territory of nowadays Romania. In 1202 the monks from Igriş founded the daughter abbey at Cârţa, near Sibiu. Cârţa is thus the most remote Eastern Europe monasteries of the Cistercian order, as daughter of daughter of Pontigny. During tartar invasion, the monasteries were definite targets for their belongings and the Igriş abbey was completely destroyed in 1241 but from Cârţa abbey there is a surviving structure, Figs. 2-3. Currently, the former Cârţa abbey belongs to the local Saxon community and is a Lutheran Evangelical church, [5].

Figure 2. *Cârţa, relics of Cistercian Abbey, Lutheran church at present*

In 1322, the king Charles I of Hungary states that ten villages were in the possession of the Cistercian monastery of Cârţa which correspond to the area between present day cities of Sibiu and Braşov and the Târnava Mare River valley. In the second half of the 13-th century, in its vicinity, on the right bank of the Olt River, two villages were founded and populated with German colonists and later in the 13-th and 14-th centuries on the Sighişoara seat, it founded other six villages situated on the right bank of the Olt River between Sibiu and Braşov, [5]. It is important to delimitate this area as Cârţa Abbey proved a direct influence in the architecture of the Saxon colonists' churches, which are most visible nowadays, but also in other major aspects of society evolution.

Figure 3. *Vestiges of Cârţa Abbey, the oldest gothic building in Transylvania*

3. ORGANIZATION OF THE CISTERCIAN COMMUNITY

A swamp was quite without value and a cause of diverse epidemics, but the monks actually developed in such places and surpassed the challenges, managed to drain the marsh and convert to productive agricultural land. They cleared forests standing in the path of human habitation but were also careful to plant trees and conserve forests, [7].

The monks introduced crops, or industries, or production methods with which the people had not previously been familiar, like the rearing of cattle and horses, the brewing of beer, the raising or fruit, the finest vineyards.

The monks establish the production of wine, which they used both for the celebration of Mass as well as for consumption, which the Rule of St. Benedict permitted. To be mentioned, the champagne was discovered by blending wines by a Cistercian cellarer, [7].

Concerning hydropower management, the abbeys followed a standard pattern: water was brought by a channel from the river over a certain distance, then separated into two sources of supply for industrial and for domestic purposes and then led back to the river, [8].

Figure 4. *Cârța abbey remains - Architectural elements*

Figure 5. *Water mill with vertical wheels at Dumbrava Sibiului, "Muzeul Civilizației Populare Tradiționale ASTRA"*

The stream ran through monastery living quarters and refectories, providing power for milling, wood working, forging, oleaginous seed crushing, crushing wheat, sieving flour, fulling cloth, and tanning. It also supplied water for cooking, washing and bathing and finally for sewage disposal, [9]. In fact, any Cistercian monastic community had its own factory and used waterpower at industrial scale, [7].

It must be emphasized the high level of technological sophistication of Cistercians and the fact that thanks to the system of communication between the various monasteries, information, including the technical one, was spread quickly, [10], [11].

It is recognized their skill in metallurgy; they needed iron for their own use but also traded the surplus; from the mid-thirteenth through the seventeenth century the Cistercians were the leading iron producers, [13]. They also produced the phosphate-rich slag from their furnaces, which was used as land fertilizer. They obtained iron of great quality, even if they didn't utilize blast furnace coke, [13].

Figure 6. *Mill Stone at Cârța church from former Cistercian mill*

Utilizing their own labor force and lay brothers, they educated and trained it to excellence. Monastic expertise multiplied throughout Europe, due to the system of continuous training they also established, by imposing annually visits of monks to mother abbey for gaining new information.

Because water power liberated hands, time for education arrived, except that books were still limited. As there were no printing presses, all the books were copied hand-writing. Those times, in the 12-th century, book factories were called *scriptoria* - places where experts copied books on a large scale. Therefore the Cistercians organized the new technology of making hand-written books: they developed the monastic *scriptorium,* invented alphabetical indexing and pagination and contributed to books production, being Gutenberg precursors, [9], [10].

4. CÂRȚA ABBEY HERITAGE

Following the principle established by the central abbey, at Cârța, the stream running from the mountains was divided and a branch redirected through the kitchen for domestic use. This kitchen is the oldest inhabited building from Transylvania and the actual cleric resides in this house.

The vineyards were renowned, they improved the local varieties because they brought varieties of noble wine from Burgundy and the aristocracy visiting the Abbey was highly interested in the wines from the cellar.

The Cistercian innovations in stonework, namely pointed arches, groined and vaulted ceilings, led architectural styles from the Romanesque to the Gothic, [11]. These characteristics are still observable on the vestiges at Cârța abbey, Figs. 3-4, and are met in numerous other medieval abbeys with fortifications from Transylvania, influenced by this style and being constructed after Cârța monastery as model, [15].

A channel with locks was constructed and the main stream was directed through, the only water mill for grains for the ten villages mentioned being built by these hard working water-engineering monks. Their mills used vertical wheels, as the ones now at the museum near Sibiu, Fig. 5 and introduced gear mechanisms.

In the present church there is a mill stone from the former water mill, Fig. 6.

As in the other abbeys, the labor of lay brothers was employed, and they worked at stone quarry across the Olt River, in crop fields and vineyards.

There is no explicit evidence that Cistercians were sheep breeders in Cârța or involved in wool industry, [15], but in the past centuries, all over our country, there were used fulling hammers, similar to the ones from Cistercian abbeys in Europe. Akin water fulling mechanisms, Fig. 7, are still exploited by the traditional manufacturers.

The first library on the territory of these days Romania was at Igriş abbey, [14] and without doubt, as any daughter abbey, at Cârța a library existed too.

Figure 7. *Fulling mill, [12]*

5. CONCLUSIONS

The Cistercian achievements in technology, industry and trade, with effects to economy and politics, present a huge extent.

Their activities included land recovery, forest conservation, advancements in irrigation, improved milling works, animal husbandry, mining, metalwork, forges, wine, glassworks, stonework, fisheries and timberworks.

The Cistercians innovations in stonework led architectural styles from the Romanesque to the Gothic.

Most important was the dissemination of innovation and technologies by applying any new verified beneficial innovative aspect in their farms and working with lay brothers, who learned and spread knowledge to laic communities.

The concept of gathering information in a central organization–the mother abbey- and afterwards training yearly the visiting brothers who disseminated the new acquired knowledge is rather modern.

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MICROSCOPIC MORPHOLOGICAL STUDY OF THE SUPERFICIAL VENOUS SYSTEM AND PERFORATING VEINS

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ABSTRACT: *The pathogenic mechanism of varicose veins should be seen whole, in all its complexity, as a result of the numerous links, the pathogenic lesion causing morphological substrate specific functional disorders, translated by clinical symptoms.*

KEY WORDS: varicose veins, varicose disease, morphological disorders

1. INTRODUCTION

The access to the means of modern investigation, powered by the increasing levels of the population's medical education led to the increasing number of diagnosed varicose disease cases, the reported prevalence being between 10% and 50% (6, 7). It is unanimously known the role of the valvular insufficiency, the dilatation and growth of the venous pressure, the controversies advise primordial factor establishment (3, 4, 5).

These modifications, which characterized the evolution and installation of the varicose disease, have however a pathogenic substrate much more deep, unsolved yet.

The object of the presented study was represented by the hysto pathological modifications analysis from the varicose veins, with the determination of the collagen structured piece, muscular and elastic of which modified quantitatively report compared to the normality status may imply venous physiology damaging.

2. MATERIAL AND METHOD

The study lot consisted in 13 patients suffering from varicose disease: 8 in CEAP stage 2-3 (sublot 1), 5 in CEAP 4-6 tage (sublot 2), hospitalized in the Dr. Victor Babes Diagnose and Treatment Centre Bucharest.

The pieces processing for the histo pathological examination was made in the Pathology Department of the National Research-Development Institute in the Pathology and Biomedical Science field "Victor Babes" Bucharest.

3. RESULTS

In the case of the varicose disease CEAP 2-2 (simple varicose), for the putter saphena, the internal saphen vein and the varicose package, the histo pathologic test in the HE standard stain showed the segmented thickness of the intima and medium, either with the even distribution on the whole fragment of the examined vein, either according to normal segments in terms of the venous wall's thickness - mentioning that, comparing to the thick zones, these segments have been considered, initially, as characterized by reducing the wall's thickness.

For the perforating veins, the general appearance was represented by the circumferential thickness of the intima and medium, uniformly across the entire harvested fragment.

On the intima level, the pavement profile of the endothelial cells were replaced with a cubic profile. For the thickened fragments, the special coloration have permitted the conjunctive tissue identification, with the obvious growing of the unfibrillated extracellular matrix quantity.

The medium tunic submitted the hypertrophic and hyperplasia of the muscular cells, smooth muscular beam with concentric disposition around the lumen becoming massive.

And at this level, special stains have allowed the net of the connective tissue, with significant increase in the amount of the fibrillar extracellular matrix and not fibrillar. The fibrillar collagen compound, organized in compact manner, with rare associated fibrocytes, sometimes included capillary type vessels (possibly newly formed by angiogenesis). The elastic fibrillar compound, extremely well represented, formed condensations in the thickness of the vein wall, as a reaction to the growing vein pressure. In the same time, there have been also broken elastic fibers, in fragments, with the isolated disposition among smooth muscular cells or collagen beams.

If varicose veins CEAP stage 4-6 (complicated varicose) the previously described histological changes in the environment have been amplified by the presence of large amounts of collagen, resulting in disruption of normal muscle cell model by splitting the muscle beams and their separation into islands, or their replacement by collagenous component in excess (Phlebosclerosis) distributed evenly in circular and longitudinal layer of average or patchy.

It should be noted that although the tunica media had large dimensions construed as hypertrophy, the smooth muscle cell count was reduced compared to the normal structure, the muscle layers of the tunica media is thinner than normal.

The following images are relevant to illustrate the morphological changes presented in the venous wall in succession investigated venous territories: putter internal saphenous vein (Figure 1), the internal saphenous vein (Figure 2), perforating veins (Figure 3).

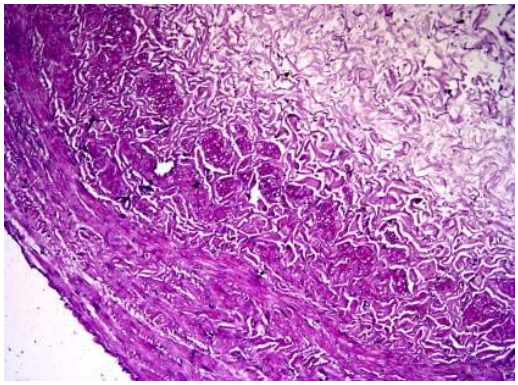

Figure 1. *Saphenous putter. Marked intimal hypertrophy, hyperplasia average muscular tunic and collagenous proliferation (HE, x 20)*

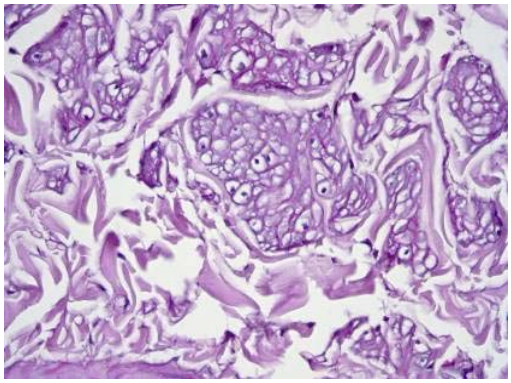

Figure 2. *Internal saphenous vein. Tunic important colagenizare average (PAS, x 40)*

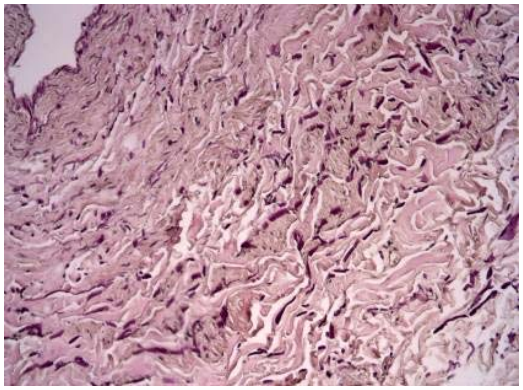

Figure 3. *Perforating vein: resilient disorganized (van Gieson, Elastic, x 10)*

Following the process of fibrosis average, there were various injuries caused by the progressive invasion of intima and adventitia. Damage of the intimal was severe being observed the endothelial detachment and replacement of the intima area, corresponding dense collagenous fiber, some being hyaline, elastic fibers hyperplasia separated. These changes led evolution towards thrombosis.

At an adventitial level, there were presented changes in the nerve endings (diffuse neuritis) and in the utensils *vasorum*. *Vasa vasorum* showed a dilated and anastomosed aspect, sometimes surrounding the affected vein and instilling in her cavernous aspect.

One case was characterized by the expansion vasorum utensils inward, penetrating the structure and causing injuries of the vegetate mezoflebite.

In light of the qualitative examination, no major differences were found between the lesions presented in the stick, the internal saphenous vein, varicose package, respectively perforating veins - all areas being concentric hypertrophy characterized either by homogeneous or by eccentric hypertrophy.

4. DISCUSSIONS

The pathogenic mechanism of varicose veins should be seen whole, in all its complexity, as a result of the numerous links, the pathogenic lesion causing morphological substrate specific functional disorders, translated by clinical symptoms. (1, 7)

The development of cellular and molecular biology techniques have allowed the deepening structural changes of the ***components of endothelial tissue***, ***connective tissue and muscle*** in the wall of the vein, resulting in a modern concept of the etiopathogenesis of varicose veins (1).

The morphological structures which are installed at major injuries are intimate tunic and average tunic. ***The main morphological changes that characterize varicose disease are the result of interference between endothelial injury, intimal hypertrophy by increasing extracellular matrix and connective tissue and also the muscular cells modification.***

In our study, in both subgroups, varicose veins showed an increasing in lumen hypertrophy (elongation and invagination) intima by the significant increase in fibrillar extracellular matrix presented at this level. (2, 4, 5)

In parallel, other lesions revealed for a subgroup of cases with simple varicose veins were the endothelial cell activation, translated by increasing the size and profile prominent intraluminal associated with the presence of intracytoplasmic vacuoles. For the corresponding subgroup of the cases with complicated varicose lesions included marked degeneration of the endothelial cells and the endothelial layer peeling. (3, 6, 7)

Varicose veins in both subgroups showed a marked development of the fibrillar extracellular matrix both in the intima and media level. For subgroup 1 - simple varicose veins, if intimately collagen fibers were arranged in compact, in the arrangement of their average was tunic of the beam, including smooth muscle cells, and breaking the sometimes invaded the muscle layer of the media.

For subgroup 2 – complicated varicose veins, the collagen produced determined an obvious intimal thickening caused amid the collagen hyperplasia, hyaline transformation installing it. In parallel, the elastic fibers hyperplasia was present. Moreover, the tunica average hyperplasia of collagen fiber bundles leading to the dissociation of the muscle and / or replace them entirely, Phlebosclerosis has been installed.

In our study, varicose veins in both subgroups were characterized by hypertrophy and hyperplasia of muscle cells in the tunica medium. These changes were more evident in subgroup 1 than subgroup 2 - in which it has been amid continuity fragmentation of muscle cells, a fibrous transformation process.

CONCLUSIONS

The study revealed the constant presence of the same damage to the vein segments taken from different areas and the comparison between the two stages - simple varicose veins (subgroup 1), complicated varicose veins (subgroup 2) confirmed the gradual evolution of the lesions, their dynamics are in direct correspondence with the clinical picture.

In the varicose disease, endothelial lesions, characterized by activation, degeneration and desquamation exposed wall components and accelerates the progression of morphological changes of other components.

For smooth muscle tissue of the tunica media, the processes of hypertrophy and hyperplasia can associate changes in the muscle cells, the presence of vacuoles, suggesting a possible role of secretory and phagocytic of them, which may explain the abnormal contractile function of smooth muscle cells in the wall of the vein.

In the connective tissue of the intima and media (not fibrillar) there is an increasing of the proportion of extracellular matrix (amorphous) and fibrillar, and structural changes occur in the elastic fibers and collagen.

Alternation of zones of hypertrophy and atrophy in the vein wall is considered as a reaction to pressure and poor perfusion at this level or a consequence of quantitative and qualitative changes of smooth muscle cells.

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ULTRASTRUCTURAL MORPHOLOGIC STUDY OF THE SUPERFICIAL VEIN SYSTEM

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ABSTRACT: *Morphological substrate research of varicose veins benefited unquestionably the possibility of penetration at the ultrastructural level by electron microscopic investigation. Analysis of the lesions indicates a ultrastructural profile installed when triggering pathogenic, adding to the personal results supporting the existence of morphological changes even non varicose clinical territories.*

KEY WORDS: varicose veins, morphological substrate, electron microscopic investigation

1. INTRODUCTION

Morphological substrate research of varicose veins benefited unquestionably the possibility of penetration at the ultrastructural level by electron microscopic investigation.

There are few studies devoted to this subject, and their construction is different - because it deals with the components of the three tunics carrying the structure of the vein wall (intima, media, adventitia) either individually or as a whole.

In this context, we considered it appropriate to summarize, as a starting point, the data on characteristics of the endothelial fibrillar extracellular matrix (collagen, elastin) and non fibrillar and smooth muscle cells (1, 2, 4, 5, 7).

2. THE PURPOSE OF THE STUDY

The objective of this study was to analyze the ultrastructural changes of the varicose veins, our investigation is focused on the structural endothelial collagen components, elastic and muscular in order to contribute to the characterization of lesions present in the intima, media and adventitia vein.

3. MATERIAL AND METHOD

The material was represented by 8 bits of the internal saphenous vein, taken from varicose territory - in 4 cases of simple veins (cases 1-4, CEAP stage 2-3) in the other 4 cases the complicated veins (cases 5-8 stage CEAP 4-6), 1 case showing vascular thrombosis. Electron microscopy study was conducted in the Laboratory of Ultrastructural Pathology of the National Institute for Research and Development in Pathology and Biomedical Sciences "Victor Babes" Bucharest.

Fragments vascular necessary in light microscopy examination - section semifinals and, respectively, electron microscopy was fixed in 4% glutaraldehyde immediately after being harvested. Inclusion of the tissue fragments was made in Epon according to standard procedure in laboratory practice. semi-fine sections (light microscopy) and fine sections (electron microscopy) were performed with an ultramicrotome RMC.

4. RESULTS AND DISCUSSION

Microscopic examination of highlighted semifinal sections the following changes:

- segmental thickening of the intima;
- endothelial cell activation, as reflected by the presence of tall cells that protrude into the lumen and the presence of cytoplasmic vacuoles;
- segmental thickening of the media;
- average length thickness of vacuolar areas presence;
- increase of extracellular matrix in intima and the media.

As a general matter, the increase in size of the vein wall was due to both changes in the intima (intimal hypertrophy by increasing the extracellular matrix) and the average (hyperplasia and hypertrophy of the smooth muscle cells in parallel with the increase in extracellular matrix). Electron examination revealed, in cells and extracellular matrix, relevant issues to

support the ultrastructural lesions. In the intimal lesions were observed consecutive endothelial cell activation: the size of endothelial cells, squamous, were increased, cells became high (cubic or cubico-squamous) and protruding into the lumen; intracytoplasmic was reported excess organelles and numerous lipid vacuoles. Endothelial basement membrane thickening and issues presented and subjacent lamellar in subendothelial tissue identified the fibrillar collagen.

Clearly, the normal structure of the internal elastic membrane was disorganized. In the muscular tunic were present shape changes of smooth muscle cells, or with the appearance of cytoplasmic extensions that extend and surround other smooth muscle cells, undergoing decay either by excessive elongation, becoming a fibrillar appearance.

Smooth muscle cells showed integrity in the cytoplasm, rich RE, which indicates an intense activity of synthesis, and numerous lysosomes, suggesting the involvement of the cell and matrix degradation activity.

Other lesions identified were: cytoplasmic fragmentation, thickening of basal lamina or its lamellar followed by fragmentation. The extracellular matrix were observed and small cell fragments, isolated, resulting in the complete destruction of smooth muscle cells. Electron microscopy revealed a clear separation of the smooth muscle cells of large amounts of extracellular matrix and fibrillar collagen fiber type I and III.

External elastic lamina disorganization was evident. The presence of other cell types at the lesion (fibroblasts and myofibroblasts) was a new element. Also it surprised the look of the fibrillar collagen, of a larger diameter than normal and completely disordered anarchic distribution without following regular assembly in parallel fiber bundles. Both average and in intimate identified numerous type arteriolar vessels, their presence is associated with areas of intramural hemorrhage. (Figure 1- 7).

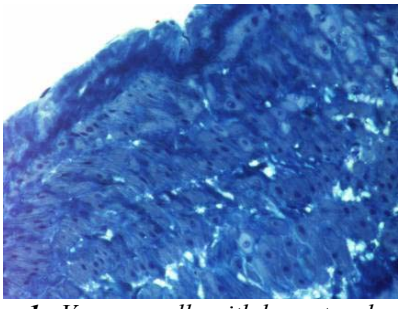

Figure 1 . *Venous walls with hypertrophy of the intima (I) average (M) is observed vacuolar areas (→) between the layers of smooth muscle cells in different directions (x Toluidine Blue 10)*

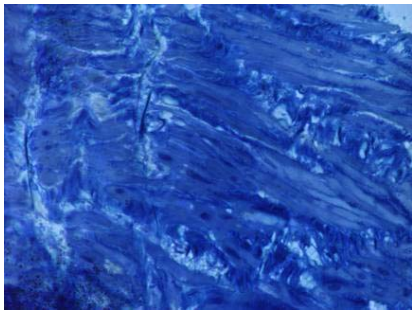

Figure 2. *Venous wall. Between the layers of smooth muscle cells with different directions are bservă collagen fibers (→) (Toluidine blue, x 40)*

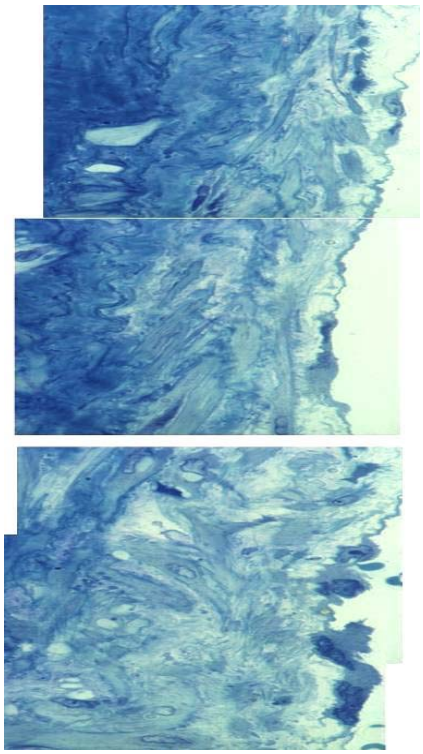

Figure 3. *Venous wall. Intima is enlarged segmental (double arrows).Smooth muscle cells (I) are present in intimate. Subendothelial spaces appear clear (*). Some endothelial cells are activated (s).L - lumen (Toluidine Blue x 20)*

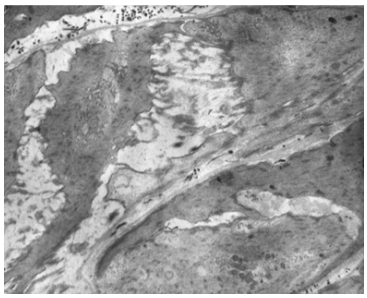

Figure 4. *Varices. Smooth muscle cells (MNCs) whose basal lamina is interrupted (→) (ME x 9,100)*

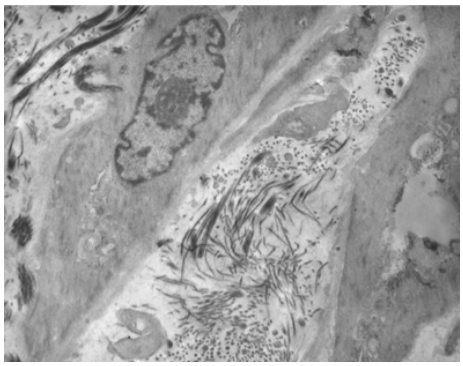

Figure 5. *Varices. Smooth muscle cells (MNCs) with expanded RER surrounded by collagen fibers with variable orientation (*) (ME x 9,100)*

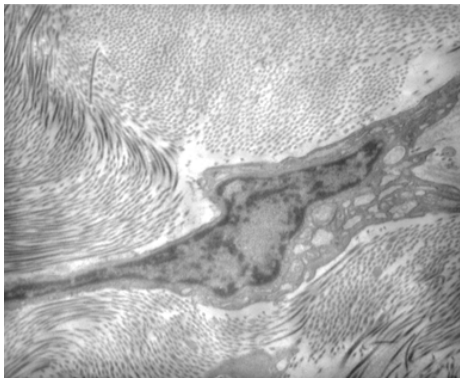

Figure 6. *Varices. Fibroblast (Fb) on average in an atmosphere rich collagenous (ME x 9,100)*

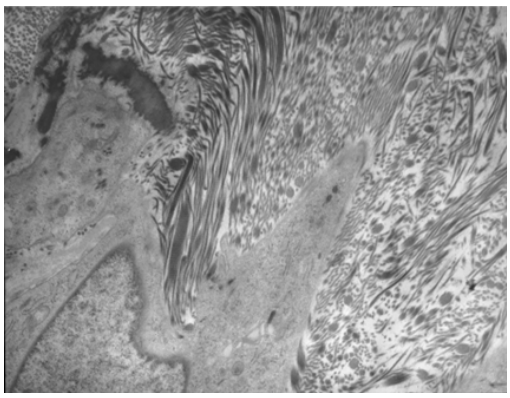

Figure 7. *Saphenous. Thrombosed varices. Myofibroblasts (MF) surrounded by fibers of collagen with variable diameter (arrows) it - elastin (EM x 9100)*

Electron microscopic analysis revealed in our study, maintaining the integrity of the vascular endothelium, endothelial cells maintaining contact with thickened basement membrane with lamellar character.

The defining characteristic of endothelial cells was the large number of cytoplasmic organelles present the level which, together with squamous profile changes in a high profile (cubic or cubico-squamous), with apparent intraluminal proeminare constitute clear morphological cell activation.

All these aspects make it possible to distinguish the activated endothelium damaged endothelium, characterized increasing the size of the cell, the appearance of vacuoles large replacing most of the cytoplasm reduced to a peripheral ring situated, cellular organelles (mitochondria mainly) partially destroyed and an increased number electron dense granules. (3, 8).

However, the identification of endothelial cells with intracytoplasmic lipid vacuoles raised the issue of early hypoxic endothelial suffering - explained by the presence of focal lesions endothelial not catched by sections for electron microscopy due to intraluminal lipids which migrate through the wall and deposited intracellularly - which could explain the clinical superficial thrombophlebitis , which sometimes complicates the cases of varicose veins.

In our opinion, endothelial cells could develop phagocytic properties - but this hypothesis should be confirmed.

There were no issues but degeneration and desquamation associated with the presence of blood cells within the vein wall.

Thus, we can say that the severity of ultrastructural lesions initiated by hemodynamic stress then becomes dependent on the degree of hypoxia consequent venous stasis.

Furthermore, the identification of isolated lesions pathogenic process signals triggering the entire length of the vein , which requires a review of the therapeutic concepts .

Assessment associated endothelial subendothelial connective tissue analysis revealed increased amount of fibrillar extracellular matrix and non fibrillar with intimal hypertrophy resulted. (9, 10).

Morphological changes of the tunic media are complex interrelationship collagen - elastin - smooth muscle cells being intensely studied , including electron microscopy , with inconsistent results.

Differences of opinion, based on different methods of measurement, targeting both collagenous component and the muscle - data reduction (1, 8, 9), growth (8, 10) or the absence of changes (3, 5, 9) thereof, compared to normal status vein.

Although all the results support the existence of a primary defect in the wall, it is unclear whether the initial event is represented by a muscle cell damage by an intrinsic defect with subsequent production of collagen, or an abnormality in the production of collagen (9, 10).

Our results are consistent with studies of ultrastructural changes of reference on *smooth muscle cells of varicose veins* compared to normal veins (3, 6, 10). Phagocytic potential was highlighted by the identification of numerous lysosomes in the

cytoplasm , and degradation of muscle cells - by the presence of smooth muscle cells with fragmented cytoplasm, being disorganized .

Other ultrastructural changes observed, is basal lamina thickening, lamellar or pausing may explain muscle loss typical average arrangement , separation and cell migration , confirmed by the presence of smooth muscle cells in intimate .

We consider highly important to investigate data from vein thrombosis, the ultrastructural changes were evident degree of severity, smooth muscle cells are the predominant secretory phenotype in association with the presence of collagen fibers with diameter uniformly higher than normal, and sudden changes in direction of the layout.

Our research has identified the presence of a large amount of *fibrillar collagen fibers* of Type I and III , to the average .

The personal results obtained correlated with the data reported in the literature, in our opinion lead to interpret the changes in the collagen component of the second step in the sequence of pathogenic events underlying morphological substrate of varicose veins, lesions consecutive steps corresponding smooth muscle cells.

The innovations that should be highlighted, however, are the emergence of other cell types at the lesion - in particular, the presence of fibroblasts and myofibroblasts - which were reported in similar studies.

The key role in the production of collagen and the degradation thereof, the smooth muscle cell-associated fibroblasts contribute to the disruption of the structural balance of the media, not only would explain the excess of collagen (which can not only be attributed to smooth muscle cell secretory phenotype) but the existence of the remote areas where the extracellular matrix is disrupted (by releasing enzymes capable of lysis) .

Myofibroblasts, which combines contractile capacity, act functional balance - its presence can be interpreted as a compensatory response, adaptive , loss of smooth muscle cells (6, 10).

In addition to the literature, our study provides a detailed characterization of collagen fibrillar ***diameter variable higher than normal status and distribution anarchic replacing parallel fiber arrangement in packets indicate a pathological assembly - specific tumor or aging processes..***
Our results are consistent with reports from mainstream publications, the main lesion observed the disruption of the internal elastic lamina.

CONCLUSIONS

In our study there were no major ultrastructural differences between intimal and media components (smooth muscle cells, collagen, elastin), corresponding territories harmed simple varicose veins (CEAP stage 2-3), respectively, in complicated varicose veins (CEAP stage 4 - 6), but a lesion evolutionary continuum in which there may be a correlation of clinical and morphological.

Analysis of the lesions detected in our study indicates a ultrastructural profile installed when triggering pathogenic, adding to the personal results supporting the existence of morphological changes even non varicose clinical territories.

Morphological evidence is passed directly to the management for varicose vein surgery, is recommended not only to remove the varicose packages but the saphenous vein stripping too.

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HVOF APPLICATIONS - STATE OF ART

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REZUMAT
În prezentul articol este prezentat, pe scurt, procedeul de pulverizare termică cu viteze mari prin accelerarea pulberilor/particulelor utilizând combustia forţată a oxigenului – procedeul HVOF. De asemenea, s-au prezentat metode de acoperire HVOF specifice domeniului medical, precum şi materialele utilizate pentru aceste aplicaţii.

ABSTRACT
This paper presents briefly, the thermal spraying process at high speed by accelerating powders /particles using the forced combustion of oxygen - HVOF process. Also, there are presented some HVOF coating methods specific to medical area and also, some material that are used for these applications.

KEYWORDS: metallic coatings, medical applications, HVOF, biomaterials, high pressure

CUVINTE CHEIE: acoperiri metalice, aplicaţii medicale, HVOF, biomateriale, presiuni înalte

1. INTRODUCTION

HVOF, High Velocity Oxygen Fuel (thermal spray coating), is a relatively new coating method which provide coatings of high density and highly resistant to wear.

The special combination of alloy is melted instantly, atomized and propelled towards the substrate at incredible speeds by a mixture of oxygen and fuel quality to those used in jet aircraft [1].

The kinetic and thermal energy of the coating particles are distributed so that it is substantially affixed to the substrate. HVOF process has become popular as metallization procedure and is very efficient in applications of ceramic and materials, and also of metallic materials, in recent years.

The project \"Applied research, technology and equipment for thermal spraying of high strength of HVOF process used in industrial and medical applications\", scientifical applicative research in metallic coating area, it proposes the implementation of a technological system which allow applied researches to accomplish metallic coatings with high mechanical strength, thermal, at corrosion on various components used in industrial or medical applications.

Developed applications are required for development of theoretical studies to determine the limits of technological parameters for proposed applications.

2. HVOF COATINGS SPECIFIC TO MEDICAL AREA

In surgical applications where bone must be rebuilt, or supported, the substitues for this are essential. Even if there are bone banks such as Eurotransplant, the natural bones are not always right, there is a danger of so-called resorption tissue.

There is also the danger of transmitting diseases and infections from the donor.

Therefore, has incrised the interest in the use of synthetic materials to replace damaged bone, they are being called biomaterials.

A class of biomaterials is that formed by coated metal devices which are used to connect bone.

In the following we describe the metallic coating methods of these devices [2].

- **Calcium phosphate coatings for medical implants**

a) Biomaterials

Biomaterials are defined as artificial materials that have been designed to induce specific biological activity. Osborn and Newesely classified the materials as follows [3]:

- biotolerant implant,
- bioinert implant,
- bioactive implant.

Biotolerant materials are surrounded by a layer of connective tissue between bone and implant. Some examples of such materials are: polymethyl methacrylate (PMMA) bone and cement made from Co-Cr alloy.

Bioinert materials such as zirconia, alumina, carbon and titanium, does not induce the formation of fibrous tissue in direct contact with the surrounding tissue.

Bioactive materials lead to the formation of chemical bonds directly with the bone. For these materials, bone texture formation starts on the surface of the implant. Subsequently, this process can induce minor side effects in the marrow of bone.

Some examples of these bioactive materials are ceramics made from glass and ceramics made from calcium phosphate.

It is clear that replacing bone, bioactive materials are preferred. In general, the mineral phase of bone, consisting of calcium phosphate, is the basis for at least the surface of the bioactive devices. Therefore, the coatings in order to improve bone bonding are usually made of calcium phosphate ceramics [4].

b) High speed spray oxy-fuel-HVOF

HVOF thermal spray process is a burning flame spray. A HVOF gun combined oxygen and fuel (hydrogen or propylene) to generate heat and extremely high particle velocities. The results of this process are: a high bond strength and density.

The flow of the exhaust gas can reach speeds of about 1700 m/s, that is supersonic, although the rate of injection is made smaller particles of 100 to 800 m/s. The flame temperature is limited to about 3000° C in a minimal amount compared with the conventional plasma spray temperature. As in any process, thermal spray, HVOF technology objective is to transfer power to both the kinetic and thermal energy, the powder particles with a high degree of efficiency and balance.

With relatively low temperatures associated with HVOF systems, the raw material is highly plastic, by heat transfer by convection preventing the overheating or the vaporization of the individual particles. When the semi-molted particles take impact with the substrate, their stabilized temperature as kinetic energy is converted into thermal energy. After the impact, the thermal component is uniformly absorbed by the substrate, whence a rapidly solidified coating with a low residual strength.

In general, HVOF coatings have a higher density and hardness and are extremely dense than most of the thermal spray coating, and improving the bond strength.

Furthermore, X -ray diffraction shows that the higher the crystalline structure is obtained in an HVOF, due to the high velocity particles and low-energy flame. This provides a decomposition of HA powder less and a better crystalline structure.

On the other hand, HA-HVOF coating has the highest porosity. When the particles are stored for too short a flame, they do not melt enough to achieve a dense layer.

Consequently, the density of thermal sprayed coatings consecutive decreases HA-HA-APS>VPS-HA>HA- HVOF.

Finally, after tests conducted in votro it is clear that in vitro – HVOF-HA is less soluble than HA -HA -APS and VPS.

Coating materials that are used for HVOF technology are generally in the form of powder [5].

Materials that are used for industrial applications

- **Powders used for pump bars for very high pressure**

The pump bars for high-pressure used in installations of waterjet cutting are usually made from the following types/brands of materials:

a) Alloy improved, STAS 42MoCr11-correspondence from 17210/DIN 17200: 42CrMo4/W 1.7225;
b) Austenitic stainless steel, STAS 5NiCr180 - correspondence DIN 17006: W 1.4301, correlation EURONORM: X 5 CrNi 18 10. The stress that are constrained these bars are: wear of the cylindrical outer surface, due to friction with consolidation fittings and abrasive particles that are accidentally entrained by cutting water; corrosion due to the work environment (for variant material).

The technical requirements that must have these pieces on the contact surface with the working environment are:

- Roughness Ra < 0.2 micrometres polished surface;
- Hardness surface must be at least 55 ... 60 HRC;
- Deviations of form (especially the deviation from cylindricity) in class 6 or 7 precision.

For this application, in particular stainless steel substrate embodiment may be used the following coating powders:

a) ***AMPERIT® 742*** *(Al2O3-TiO2 97/3 melted)*

The first version of the selected material is an oxide (ceramic), highly resistant to wear and corrosion. The main characteristics of the material after thermal deposition are:

- chemical composition: Al_2O_3 - TiO_2;
- an average particle size in μm: 45/22;
- use common areas: aircraft turbines;
- corrosion resistance: in a humidified atmosphere;
- resistance to friction sliding friction, abrasive erosion;

- other properties: smooth, low friction coefficient;
- typical deposition process: APS plasma, HVOF (less than typical);
- the maximum working temperature: 1100° C;
- technical-chemical characterization oxide;
- way of obtaining the powder: fusion.

b) ***AMPERIT® 558*** *(WC-Co-Cr 86/10/4 crwded, sintered)*

The second selected material is a sintered tungsten carbide with 10% cobalt and 4% chromium. The carbide is uniformly distributed in the matrix of cobalt-chrome and it has a particle size of less than 2 μm.

The figure below shows the distribution of tungsten carbide particles which have an irregular shape, in a matrix of cobalt-chrome.

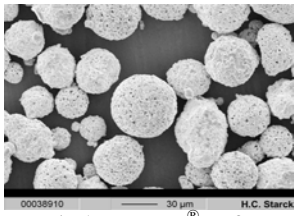

Figure 1. *AMPERIT® 558 powder*

The main characteristics of the material after thermal deposition are:

Chemical composition

Formula WC-Co-Cr 86/10/4
Carbon (C) 5,0 … 6,0% ,
Chromium (Cr) 3 – 5%
Oxygen (O) max 0,2%,
Iron (Fe) max 0,8%
Cobalt (Co) 8,5 %,
Tungsten (W) remaining.

Phisical characteristics

Particle size distribution for shorts used:
- used sort: 554 074
- particle size distribution: 45/15 μm;

Chemical composition: WC-CoCr;
Particle size in μm: 86/10;
Common areas of application: hydraulic piston bars;
Corrosion resistance: in a humidified atmosphere;
The resistance to friction: sliding friction, abrasive erosion;
Other properties: smooth, low friction coefficient;
Typical deposition process: HVOF, flame thermal deposition
Maximum operating temperature: 500 ° C;
Chemical standpoint: carbide
How to obtain powder: cluster +sintering.

- **Powders used in molds for plastic deformation**

Molds for plastic deformation, especially those drawing are complex devices with active parts profiled widely used to achieve many sheet benches.

The proposed powder that will be used for HVOF coating is a tungsten carbide made by sintering/ compaction and sintering, very easy to use, where his WC particles are homogeneously distributed in the Ni matrix. Codifying this as HC Stark company products is Ampere® 547.

The figure below shows the particle distribution of tungsten carbide, having the form approximately spherical nickel matrix [8].

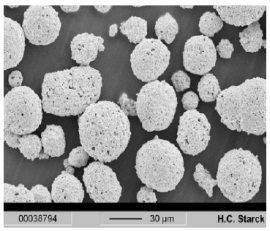

Figure 2 .: *Pulbere AMPERIT® 547*

Chemical composition

Formula WC-Ni 88/12
Carbon (C) 5,2 … 5,6% ,
Nickel (Ni) 11 – 13%
Iron (Fe) max 0,2%
Tungsten (W) remaining.

Phisical characteristics

Particle size distribution for shorts used:
- used sort : 547.074
- particle size distribution: 45/15 μm ;
- bulk density: 4,7 – 5,6 g/cm^3.

- **Powders used in molds for casting glass**

Glass casting molds are simple constructive than plastic deformation, they having significant thermal stresses.

The functional role is to transmit the external shape formed glass containers [9].

HVOF coating powder used was the same for the two samples, this being obtained by spraying, are homogeneous mixtures of Ni and Cr in an almost spherical morphology. The powder is auto fuse.

The figure below shows the particle shape of the nickel matrix [8].

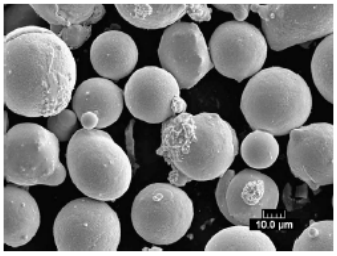

Figure 3 . *Microscopic appearance of the powder AMPERIT® 335*

Chemical composition

Formula NiCrBSi 75/45
Chromium (Cr) 13 – 17%
Carbon (C) 0,6 … 1,2% ,
Silicium (Si) 4,0 – 5,0%
Boron (B) 2,75 – 3,50 %
Iron (Fe) 3,0 - 6,0%
Nickel (Ni) remaining.

Phisical characteristics

Particle size distribution for shorts used:
- used sort: 547.074
- particle size distribution: 75/45 μm ;
- apparent density: 3,8 – 4,6 g/cm^3.

- **Materials used for medical applications**

HVOF process specific to medical applications are very diverse, they cover a wide range of products and areas.

It is of interest to medical coverage which find their counterpart in Romania and applications that are suitable for specific equipment manufacturing companies in the country. Viewed from this angle, hydroxyapatite deposition applications will be addressed in the country there are no manufacturers of implants [10].

The analyzed benches are:
- surgical instruments: bistoury, etc.
- electrostatic insulating coating for surgical instruments.

Powders used for surgical instruments

Surgical instruments are usually made of special steel, which usually must have high resistance properties to withstand chemical corrosion and stress moderate friction.

A suitable material for these is a tungsten carbide, such as Ampere ® 558 (WC-Co - Cr) [11].

Powders used in electrostatic isolate for surgical instruments

The electrostatic isolation of surgical instruments is particularly intended for laparoscopic surgery: scissors, forceps, etc.

The used materials have some deficiencies of limited reliability due to their combustion in the contact with the base material due to requests electro - thermal (heating to rezecării tissues).

One such material must have the following conditions [12]:

- be steel;
- be resistant to thermal stress;
- be resistant to chemicals.

One such material is an aluminum oxide, such as Al_2O_3 (*AMPERIT ® 742*), the material described above [10].

CONCLUSIONS

In terms of materials that can be used for specific HVOF applications present the following conclusions:

a) For industrial applications have been indicated for the following application materials:
- pump bars for very high pressure used in plants waterjet cutting;
- molds for glass;
- molds for plastic deformation of metals.

The materials that can be used in HVOF process, there are the following two types:
- carbides such as WC-Co or WC-Co-Cr based on the type of application;
- nickel based alloys such as NiCrBSi;
- oxides, such as Al_2O_3.

b) For medical applications have been indicated for the following application materials:
- surgical instruments;
- electrostatic coating for paroscopic surgical instruments.

The materials that can be used in HVOF process, there are the following two types:
- carbides such as WC-Co and WC-Co-Cr for surgical instruments;
- oxides, such as Al_2O_3.

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THEORETICAL DETERMINATION OF TECHNOLOGICAL PARAMETERS SPECIFIC TO HVOF PROCESS

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REZUMAT

Articolul are ca obiectiv estimarea limitelor parametrilor tehnologici in pulverizare termică HVOF, pentru aplicații practice, pornind de la studii teoretice şi utilizând date din literatura de specialitate şi din experiența acumulată. Lucrarea specifică pulberile de metalizare HVOF utilizabile pentru fiecare caz analizat în parte.

ABSTRACT

Article aims to estimate the limits of technological parameters in HVOF thermal spraying for practical applications, from theoretical studies and using data from specialized literature and from experience. The paper specifies about HVOF metallization powders used for each case that is analyzed.

KEYWORDS: HVOF, technological parameters, thermal spraying, carbide, NI alloys

CUVINTE CHEIE: HVOF, parametri tehnologici, pulverizare termică, carburi, aliaje NI

1. INTRODUCTION

The project "Applicative researches, technology and technologic equipment for thermal spraying of high strength by the HVOF process used in industrial and medical applications", proposes the implementation of a technological system which to permit applied researches to realise metallic coatings with high mechanical strength, thermal, at corrosion on various components used in industrial or medical applications.

Developed applications are required for development of theoretical studies to determine the limits of technological parameters of thermal spray.

2. GENERAL STRUCTURE OF A TECHNOLOGIC SAMPLE OF THERMAL SPRAYING - HVOF

The HVOF (High Velocity Oxygen Fuel) procedure is used for covering workpieces surfaces with materials by thermal spraying with flame with high speed, through the continuous introduction of a mixture of metal powder and gas with high pressure in a combustion chamber.

As a result the metal powder particles are accelerated to very high speeds which leads to layers of particles deposited with high-density and very good adhesion [4, 5, 14].

In the HVOF process the fuel, gas or liquid, is introduced into the combustion chamber together with oxygen, while a spark initiates combustion and exhaust gas, formed by a nozzle, passes through a cylindrical body and comes out into the atmosphere. The powder is fed radial or axially into the jet. The cylindrical body, the combustion chamber and nozzle are intensely water-cooled

In figure 1 [1] is presented schematically the way the specific material of spraying jet is formed in HVOF. The significance of the notations is as follows: (1) the burning gas and oxygen feeding system;
(2) feed with metal particle powder + gas;
(3) the firing nozzle with or without water cooling;
(4) HVOF flame: mixture of combustion gas + oxygen + particles;
(5) the surface on which it is applied the powder.

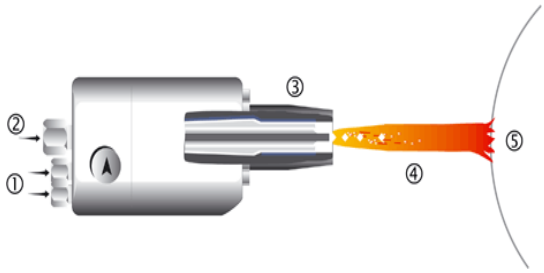

Fig.1. *General representation of a HVOF process [1]*

When metallic coatings are realised can be found one of two ways: either applies in series

When the HVOF method is applied for the production of some new workpieces all technological parameters [6] necessary to meet the technical requirements of the parts concerned, the developed activities are only those of control of the process.

In the case when it is necessary to develop new applications, where are known only the future requirements for the workpieces, are needed activities production for new parts, or is used in the process of reconditioning of existing pieces.

of research /development regarding both the materials that can be used to cover and as well the parameters of the technological process.

In figure 2 is shown the methodology of research/the development of new metallization applications, also valid for HVOF process.

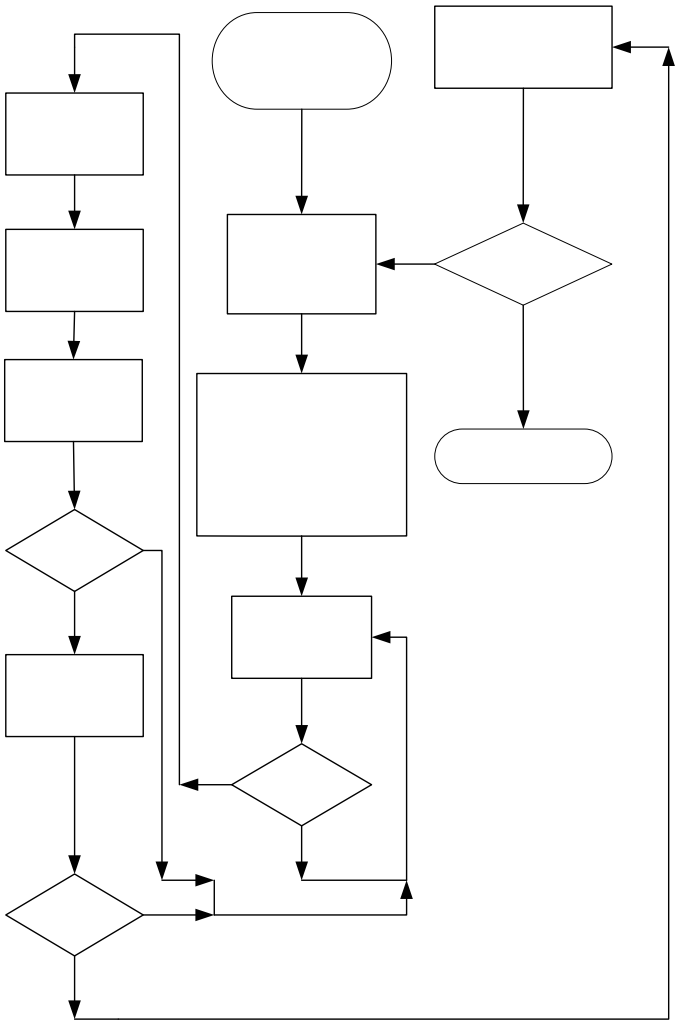

Fig. 2. *Methodology for the elaboration of new coatings*

In general, a process of technological thermal processes by HVOF coating [11] consists of the following stages:

• **preparation of surfaces for coating** (cleaning the surface, forming the substrate, activation of the surface, masking);
• **submission of HVOF coating material** on the support material;
• **applying treatments / technological operations after filing the material** (heat treatment-electro-magnetic, in the furnaces, hot isostatical pressure, flame remelting);
• **impregnation** (surface coating /sealant with organic substances, surface coating /sealant with inorganic substances),
• **finishing** (grinding, lapping and polishing).

3. TECHNOLOGICAL PARAMETERS SPECIFIC TO THE HVOF PROCESS

Parameters that characterize the HVOF process [6] are classified into:

1. process parameters which describe the components that process carries out the melted metal that is deposited, these being: HVOF flame, the powder used and the parameters of powder injection,
2. technological parameters, related to the necessary bound between the HVOF gun and workpieces, velocity, etc.

3.1. PROCESS PARAMETERS

The flame, as working environment is made up of oxygen, O2, as gaseous medium and a fuel [11], which may be constituted from:

- gaseous hydrocarbides such as ethylene (C_2H_2), propylene (C_3H_6), propane (C_3H_8), and natural gases as a mixture of several hydrocarbides and some components without hydrogen;
- liquids hydrocarbides such as kerosene, which is a distillation of petroleum products at temperatures of 320 ... 550 K and is used as fuel in reaction engines, this being sprayed before introduction into the flame.

The main parameters [6, 11] that have the purpose of determining the emerging jet, are the number of 3, as follows:

- **the pressure in the combustion chamber**,
- **the nozzle**,
- **stoichiometry** of mixed fuel with oxygen in terms of combustion reaction.

The pressure in the combustion chamber can vary according to the literature [11] from 0.3 to 1 MPa, in a typical HVOF spraygun, up to 4 MPa, in particular applications. Velocity of the material deposited is influenced directly by the pressure, the more it is higher, the higher the rate of deposition, this growth can be attributed to, most likely, the higher viscosity of the flame.

In terms of the profile of the nozzle [11], may be used the following types of profiles: convergent cylindrical body, convergent-divergent nozzle, nozzle body convergent-divergent. These profiles influence the flow way of the flame and its speed.

For a HVOF process, one of the important characteristics of the flame results from the supersonic velocity of the expansion gas expelled from the combustion chamber [11].

The sound velocity is reached at the flame out from the spray gun and the expansion into the atmosphere consists of a wave model of the rebound and compression and the so called shock diamonds of particles that are characteristic of a supersonic flow.
Rate calculations for the speed calculated for different HVOF sprayguns have results such as [16, 17]:

- for a Diamond spraygun from the company Jet Metco, working with mixture of propylene and oxygen and values of Φ=1, have resulted temperatures of the flame up to 2500 K and max speeds of 1600 m/s;
- for JP-5000 srayguns or Jet Kote, working with liquid fuel and oxygen $C_{10}H^{20}$, in stoichiometrics conditions, have resulted temperatures up to 3000 K and velocities up to 2000 m/s.

Powders used are characterized by many parameters [13] which have been studied activities dedicated to covering materials used, among which the most important are:

- particle size;
- chemical and phase composition;
- internal and external morphology, including the shape and internal porosity;
- high temperature behaviour, metered by DSC (differential scanning colorimetry) , DTA (differential thermal analysis) and TGA (termogravimetric analysis);
- apparent density and fluidity.

From the point of view of the technological process can be identified the following key parameters:

- used particle size is usually in the range 5-45 μm [2];
- the nature of the powder used: most commonly used are composites with carbide and metal or alloy matrix, but lately is used to covering oxides or some pure metals [7, 8, 9].

Parameters of powder injection in the emergent gas jet are the following [10]:

- direction of powder injection, which can be: radial, in the cylindrical body, (e.g. HVOF spraygun type JP-5000 from Praxair ST company), axial, into the combustion chamber (HVOF spraygun HV2000 of the same company);

- flow rate of injected powder is from 20 to 120 g/min;
- gas transporter of from the powder from the container to the spray gun is nitrogen or argon;
- powder dispensers are usually of the type with rotating platter.

3.2.TECHNOLOGICAL PARAMETERS

Technological parameters are bound by ties that are required between submission HVOF spraygun and the workpieces, speeds, etc. [6]. It is recommended that:

• the distance between the spraygun and workpiece to be 150-300 mm; this is slightly higher than at the plasma deposition due to large convective heating of the support substrate.

• the depositing atmosphere is air, an inert gas or vacuum.

• temperature of the substrate should be maintained at 373-473 K when are ceramic materials on metals to avoid residual tension, and in the case of melting of the self-fondant alloys can grow up to 1000 K;

• the usual thickness of layer deposited is 100-300 μm;

• the flow of material deposited is usually in the range of 1-9 kg\/h;

• the usual thickness of a layer deposited made from a crossing is 10 ... 20 μm.

4. PROJECT SPECIFIC APPLICATIONS – HVOF TECHNOLOGICAL PARAMETERS

The HVOF technological processes coating is common both for industrial applications as well as medical ones, what creates differences are the following parameters [4, 8, 9]:

• material deposited (chemical composition of the powder);

• the procedure chosen (HVOF with gas or fluid);

• support material.

In terms of these parameters will be analyzed the possible regimes to be applied to specific areas of the project.

4.1. TECHNOLOGIC PARAMETERS FOR CARBITES DEPOSAL

Technological parameters that may be used for carbides submission are shown in tables 1 and 2 for two types of carbides [3, 12, 15].

Table 1. *Technological Parameters for WC-Co-Cr*

No.	Deposed material	Technologic operations for HVOF covering	Values for the technologic HVOF covering regime
1	**2**	**3**	**4**
1	WC-Co-Cr 86/10/4	*Operations of surface preparation / Abrasive cleaning*	
		Used abrasive particles	Corindon
		Particle size (μm)	500
		Air pressure (MPa)	6
		Used air flow (N m^3 / h)	4,33
		Abrasive cleaning time (min)	5,5
		HVOF Technologic process – gaseous fuel	
		Connecting material deposited (if it's necessary)	It is not necessary
		Debit of the deposited powder (g/min)	60
		Debit of the used gas fuel (propylene) (N l/min)	77
		Pressure of the gas fuel–propylene (bar)	6,9
		Oxygen debit (N l/min)	253
		Oxygen pressure (bar)	10,3
		Compressed air debit (N l/ min)	376
		Pressure of the compressed air (bar)	6,9
		Distance between the spaygun and the workpiece (mm)	230
		Relative speed between the spaygun and the workpiece (m/min)	130
		Number of passing	18
		Thickness of the deposited layer (μm)	180
		Technological operations applied after the deposing	
		Grinding	-
		Used abrasive particles for the abrasive cleaning	Corindon
		Particle size (μm)	500
		Air pressure (MPa)	6
		Used air flow (N m^3 / h)	4,33
		Abrasive cleaning time (min)	2,5

Table 2. *Technological Parameters for WC-Ni*

No.	Deposed material	Technologic operations for HVOF covering	Values for the technologic HVOF covering regime
1	**2**	**3**	**4**
2.	WC-Ni 45/15	*HVOF Technologic process – liquid fuel*	
		Connecting material deposited (if it's necessary)	It is not necessary
		Flow of the deposed powder (g/min)	100
		Flow of the used fuel (l/h)	22,7
		Flow of the used transport gas for the powder (N l / min)	9
		Distance between the spaygun and the workpiece (mm)	380
		Oxygen debit (N l/min)	792
		Oxygen pressure (bar)	7,2
		Relative speed between the spaygun and the workpiece (mm/min)	130
		Number of deposited layers	20
		Total thickness of the deposited layer (µm)	200
		Technological operations after coating	
		Polishing	-
		Particles used at abrasive cleaning time	Corindon
		Particle size (µm)	300
		Air pressure (MPa)	6
		Debit of the used air (Nm^3/h)	4,33
		Abrasive cleaning time (min)	5
		HVOF Technologic process – liquid fuel	
		Connecting material deposited (if it's necessary)	It is not necessary
		Deposited powder	NiCrBSi 75/45
		Deposited powder flow (kg/h)	5,9
		Flow for the used fuel - kerosene (l/h)	22,7

4.2. TECHNOLOGICAL PARAMETERS FOR THE NICKEL BASED ALLOYS DEPOSION

Technological parameters that may be used for the deposition of nickel-based alloys are presented in table 3 [15].

Table 3. *Technological parameters for the nickel based alloys*

No.	Deposed material	Technologic operations for HVOF covering	Values for the technologic HVOF covering regime
1	**2**	**3**	**4**
3.	NiCrBSi 75/45 autousable	*Operations of surface preparation / Abrasive cleaning*	
		Used particles for abrasive cleaning	Corindon
		Particle size (µm)	300
		Air pressure (MPa)	6
		Flow of the used air (Nm^3 / h)	4,33
		Abrasive cleaning time (min)	5
		HVOF Technological process – liquid fuel variance	
		Connecting material deposited (if is not necessary)	It is not necessary
		Flow of the deposited powder (kg/h)	5,9
		Flow of the used fuel – kerosene (l/h)	22,7
		Flow of the gas used for the powder transport (l/min)	9,9
		Distance between the spaygun and the workpiece (mm)	230
		Relative speed between the spaygun and the workpiece (m/s)	0,2
		Number of the deposited layers	28
		Ttotal thickness of the deposited layer (mm)	300
		Applied technological operations after the deposion	
		Remelting by induction	
		Polishing	

CONCLUSIONS

From the conducted study have resulted the following conclusions:

- technical data collected are valuable information for choosing the specific key components of HVOF equipment that will be used to achieve the objectives;
- it is considered that the obtained theoretical data are enlightening in terms of the technological processes of HVOF coating for both industrial as well as for medical applications following to be used in future activities of the project, the facility will be made on installation developed the beneficiary of the project.

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