

Darko Novosel, Tatjana Novosel & Ingrid Novosel¹

VALMOD PROGRAM MULTIDIMENSIONAL APPROACH TO THE THERAPY OF STUTTERING

1. INTRODUCTION

Human brain is associated with interpersonal communication where special attention is paid to the liaison brain and modules, a special group of neurones which function differently from other parts of the brain, that is, they behave according to the rules of exchange of information. The brain can be activated or pacified, in other words, its modules can open or close, they can function or cannot function, depending on the dynamics of interpersonal communication. Modern science on the development and functioning of the central nervous system draws our attention to the fact that brain is a "relative organ", meaning it is essentially connected in its operation and functioning to the intensity and quality of the immediate relationships with the other significant organs within the vital relevant interpersonal systems. Consequently, central nervous system is not only genetically determined, neuroanatomically and neurophysiologically interpreted, but it is significantly connected to the relative interpersonal atmosphere, to what is happening on the intimate social relative plan (Eccles/Zeier 1984).

Each individual should and must communicate within its natural systems with different partners. Speech, as the basic means of communication, holds a special position and significance in quality and realisation of communicative goals. Regardless of its origin, every system owns its balance to a built-in system of control, which receives information, compares them with the established standards, decides on the amount and the direction in which the correction should be made, in accordance with the approved information.

In the framework of automatic regulation, speech is a very complex regulatory system with rigorous criteria for its own stability, linked with and in direct connection and function with many other systems in the body. The feedback principle is the basic characteristic of every system in the human organism, while the integrative role from the smallest segment to the functional parts and the whole belongs to the nervous system. So, the basic principle of the theory of regulation is feedback and without it a certain function cannot be adequately realised (Novosel, D. 1992a).

In such a context stuttering can be observed as an instability in the regulatory system, which does not include feedback and the necessary information on the occurrences within the system, and without regulation this leads into even greater instability of the system.

¹ Prim.dr.sc. Ivan Pavliček, neurologist, and Prim.dr.sc. Miroslav Pospis, pediatric neurologist, acted as reviewers (recenzenti) of this article.

Regarding the etiological variety in approach to the problem of stuttering and the existence of different theories and explanations, the very treatment of stuttering poses no smaller a problem and mystery. Stuttering is a kind of speech disorder or interpersonal communication disorder the consequences of which differ from one person to another. Due to manifold system and complex speech and language functioning which requires a high functional harmony in its every segment, there are relations which, due to their sensibility, get more or less disturbed at a certain point. This disturbance suffices to disrupt the speech and language process and the speech and language productive component at that moment.

2. PREVIOUS RESEARCH

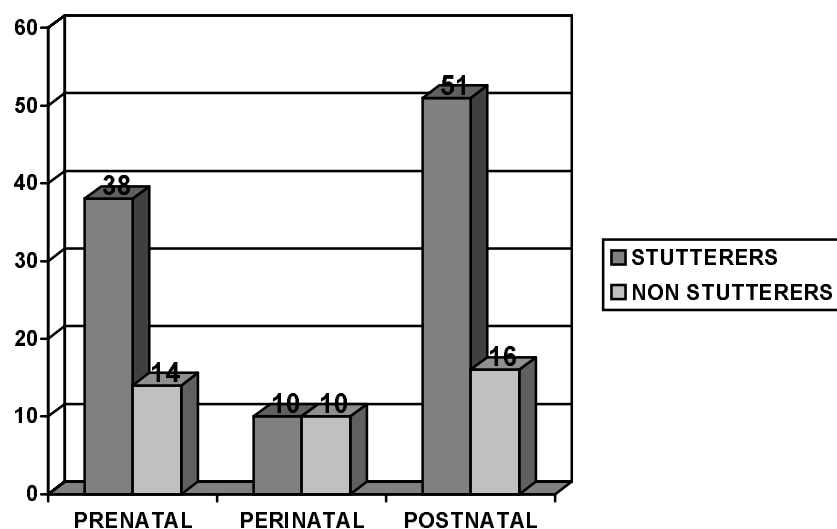
Our research started at the Speech and Hearing Rehabilitation Centre of General Hospital Varaždin in 1982.

2.1. Neurorisk Factors

It all started with the research of neurorisk factors in prenatal, perinatal and postnatal period on a sample of 45 stutterers and 45 non stutterers aged between 9 and 14 (Novosel, D. 1982a & b).

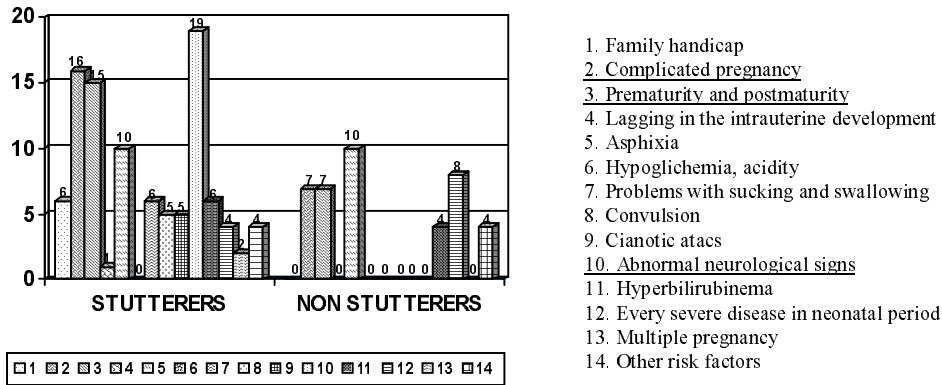
The incidence of neurorisk factors in prenatal, perinatal and postnatal period is found to be in the ratio 4:1 in favour of stutterers (*Chart 1.*).

Chart 1.
Incidence of
neurorisk
factors.



The most frequent of all neurorisk factors are complicated pregnancy, prematurity, post-maturity and abnormal neurological signs (*Chart 2.*).

Chart 2. Incidence of different neurorisk factors.



2.2. Motor coordination of movement

The same sample groups were used to test the speed of leg tapping (*Chart 3.*), hand tapping (*Chart 4.*) and hand coordination (*Chart 5.*). According to the results, children stutterers displayed a statistically important difference in motor coordination ability, compared to the control group (Novosel, D. 1982a).

Chart 3. Leg tapping
no significant difference in speed of leg tapping between stutterers and non stutterers

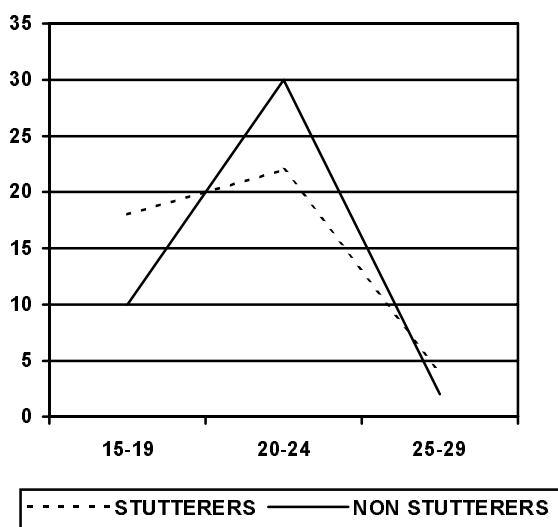


Chart 4. Hand tapping
no significant difference in speed of hand tapping between stutterers and non stutterers

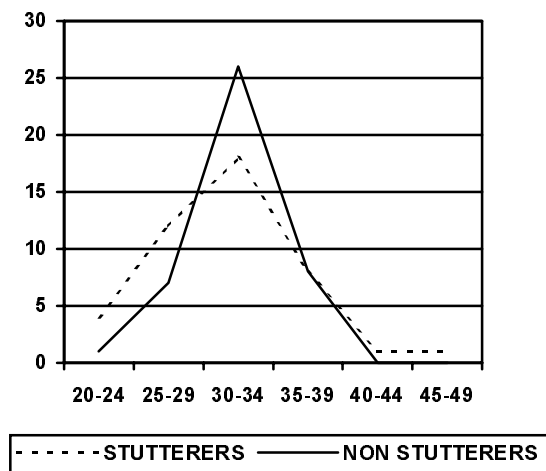
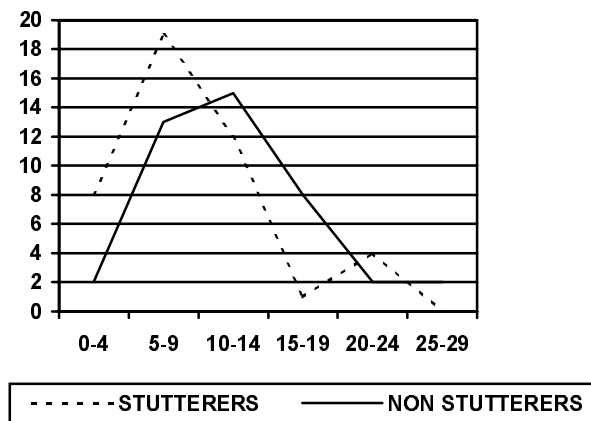


Chart 5. Hand coordination.
significant difference in hand coordination between stutterers and non stutterers



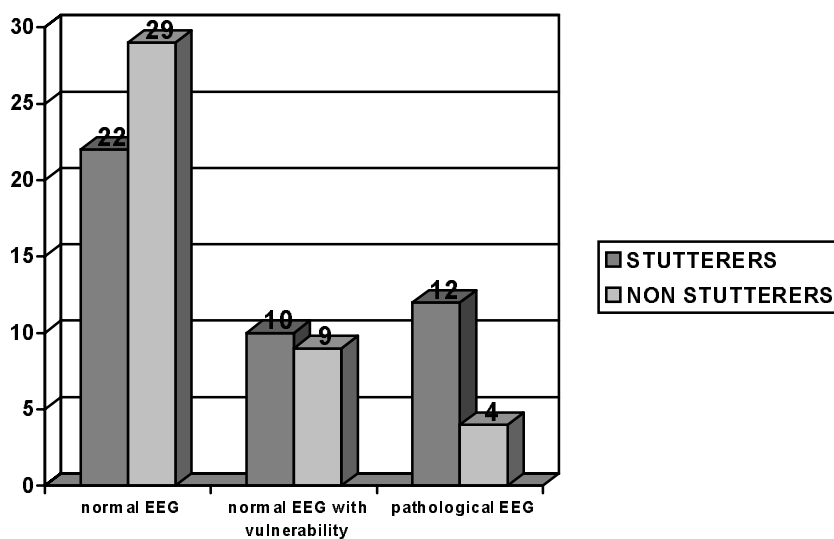
2.3. EEG Findings

Many previous research into the relation "EEG – stuttering" have given different results. Assuming that the presence of neurorisk factors and differences in motor coordination can be predispositions for elements of organically based stuttering, a research has been launched into electric brain activities on a sample of 44 stutterers and 42 non stutterers of both sexes aged between 9 and 14. The results show there is no statistically significant difference in EEG findings results between these two groups. Neither is there a difference between stuttering intensity and EEG findings. Regarding the chronological age of persons while using

provocative methods (photoaudiostimulation, hyperventilation), a mild disruption of the main cerebral rhythm occurred, which is normal with unfinished brain electrogenesis (*Chart 6.*) (Novosel/Brestovci 1988; Novosel, D. 1982a).

Chart 6. EEG findings.

no significant difference between stutterers and non stutterers
 no correlation between the intensity of the stuttering and the EEG findings

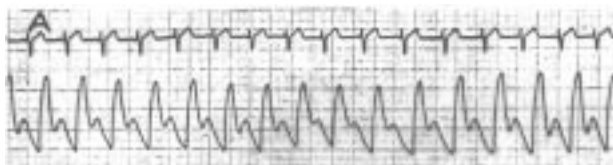


2.4. Photoplethysmography

Photoplethysmography (*Image 1.*) showed that people with severe stuttering (N = 9 persons, chronological age between 16 and 24) have normal pulse frequency and normal curve of the photoplethysmogram in the phase of relative relaxation and silence. In the prephonatory phase the pulse frequency rises and the curve of the photoplethysmogram lowers, which means that the blood flow on periphery is reduced. These differences are even bigger in the speech phase. Two seconds after speech the pulse frequency lowers and blood flow is normalised. These changes also point to the alarming situation occurring just before and during speech production (Detoni/Novosel 1989).

Image 1. Pulse and Photoplethysmography by severe stuttering

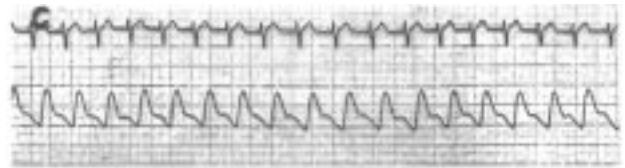
The frequency of the pulse (upper line) and the curve of the photoplethysmogram (lower line) in the phase of the relative relaxation and silence.



The frequency of the pulse (upper line) and the curve of the photoplethysmogram (lower line) in the prephonatory phase.



The frequency of the pulse (upper line) and the curve of the photoplethysmogram (lower line) in the phase of speech.



The frequency of the pulse (upper line) and the curve of the photoplethysmogram (lower line) two seconds after the speech (silence).



2.4. Pulse and blood pressure

When taking pulse and blood pressure, a statistically significant difference has been established between stutterers (N = 44 persons) and non stutterers (N = 44 persons) (*Chart 7.*). *Charts 8.* and *9.* show significant differences in measured parameters before and after therapy in the stutterers group (Novosel, D. 1982a).

Chart 7. Blood pressure in the phase of silence and speech phase in the stutterers group and non stutterers one.

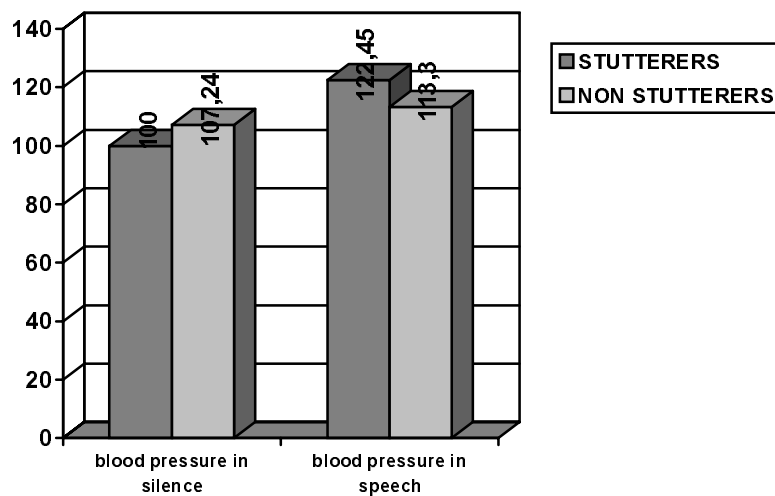


Chart 8. Autonomic manifestations in persons who stutter (before the therapy).

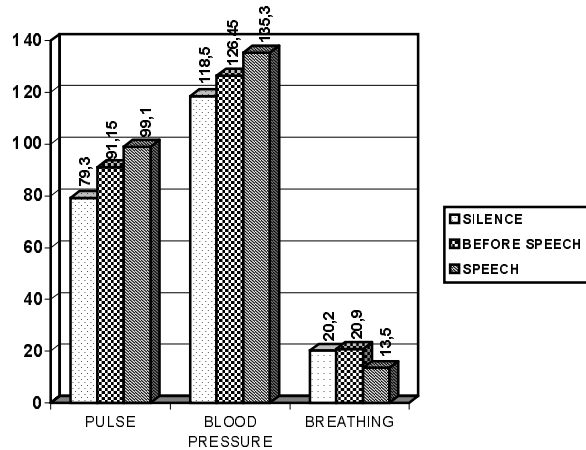
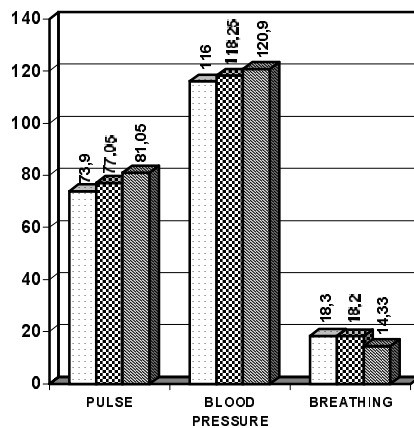


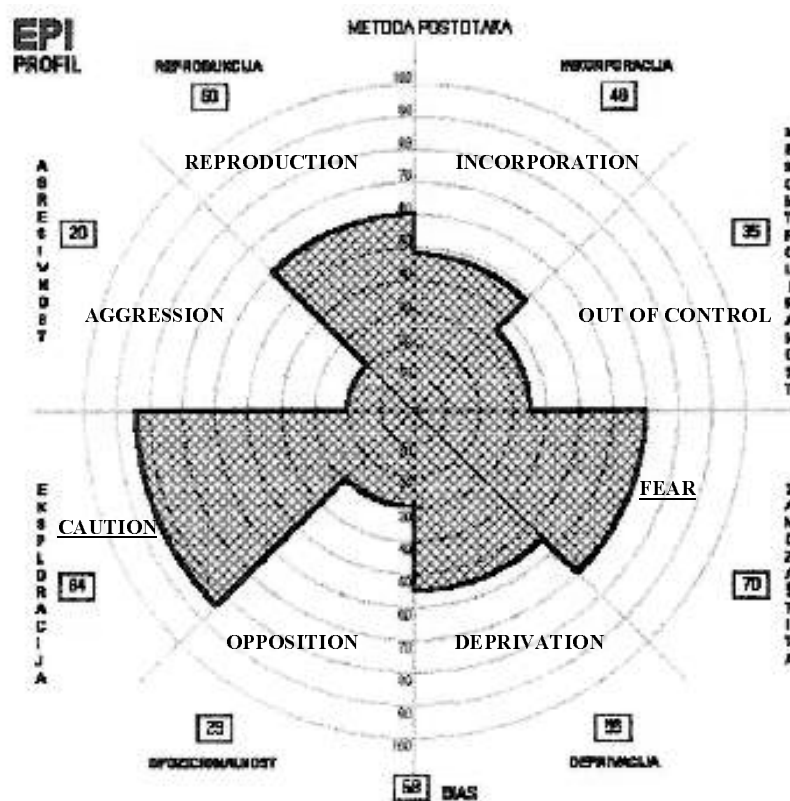
Chart 9. Autonomic manifestations in persons who stutter (after the therapy).



2.5. Emotional dynamics

Research into emotional dynamics of stutterers (N = 41 persons, chronological age between 9 and 16) using Plutchik model *PIE* (Profile Index Emotion) has shown that stutterers display a high degree of anxiety, namely caution and fear as dominant emotions. *Chart 10.* shows an example of such negative emotional distribution (Ozimec/Novosel 1985).

Chart 10.
Profile
Index
Emotion
(R. Plutchik)



2.6. EMG Biofeedback

One of numerous researches on a sample of 45 stutterers and 45 non stutterers, chronological age between 15 and 24, and which was of a special significance for therapy strategy, was measuring the muscle tension and the duration of larynx muscle tension using special *Ghetaldus – 161 electromyograph* and program. The research proved statistically significant difference in the presence of higher larynx muscle tension in prephonatory speech phase of stutterers. It has also confirmed that the contraction duration significantly influences the stuttering intensity (Novosel, D. 1990; Novosel/Novosel/Novosel 1999; Novosel/Ribić 1984, 1985, 1986; Novosel, T. 1996).

The EMG biofeedback techniques is rather widely applied in the therapy of stuttering, but even in such treatments there are some understatements, disagreements and differences (not meeting the criteria of the biofeedback technique, small groups of examinees) which should be further scientifically tested (Beaty 1980; Freeman 1985; Ham 1986; Hanna et al. 1975; Kalotkin et al. 1979; Peters et al. 1989). Because of these differences Novosel/Ribić (1984, 1985, 1986) designed equipment with computer programme developed only for the

EMG biofeedback technique. *Ghetaldus 161 – EMG biofeedback* equipment registers the frequency of impulse appearance, that is, we measure time (t). The shorter the time of impulses is, the higher the voltage (integrated potentials). It is recommended to record the muscular contraction, which is proportional to the frequency of the impulse appearance. Summing up the integrated muscular signals, we obtain relatively high voltage which changes slowly and suitable for biofeedback. These advantages enable to registration of even the smallest change inside the muscle we observed. Our experience has proven that this way of recording is the best, so the units on the instrument actually show psychological contractions and it is not calibrated in frequency or voltage. We cannot talk about the voltage of a single impulse as we deal with integrated voltage. This is the degree of contraction, in other words, what we can see and what we are interested in is only the area from the relaxation to the highest contraction (Novosel, D. 1990, 1996).

This essential difference makes direct comparison of the obtained results by the two measuring methods impossible. *Ghetaldus 161 EMG biofeedback* equipment cannot be used in diagnostics because of the mentioned reasons. On the other hand, a standard EMG equipment cannot be used successfully for the biofeedback technique without an additional adaptation and processing of the signal (Novosel, D. 1996).

3. APPROACH TO STUTTERING

VaLMod program (Varaždin speech pathology model) has been created on the basis of findings results. It approaches and examines stuttering from four basic aspects:

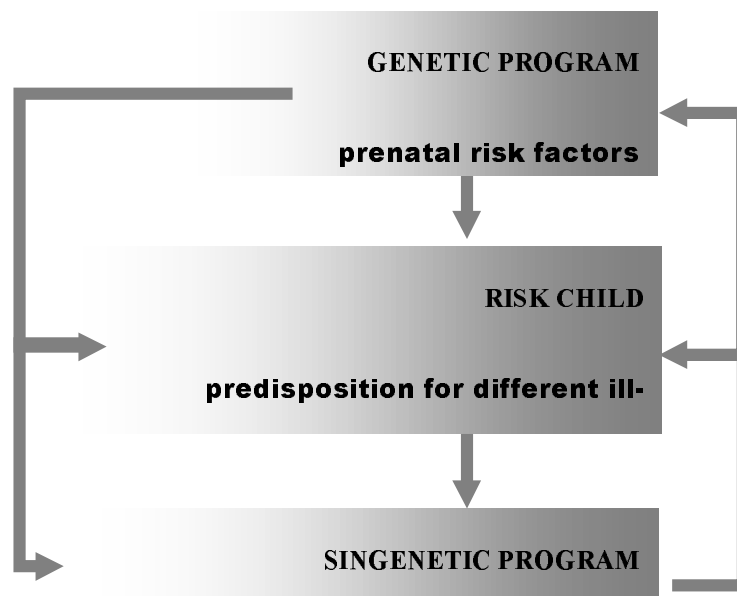
1. aspect – medical aspect
2. aspect – interpersonal dynamics of stuttering
3. aspect – individual psychodynamics of stuttering
4. aspect – physiology of stuttering.

3.1. Medical aspect of stuttering

Medical aspect of stuttering involves collecting all relevant information concerning inheritable component of stuttering, neurorisk factors in prenatal, perinatal and postnatal period, intra-uterine stress, illnesses and disorders in early childhood in order to establish the level of risk. If risk factors are discovered in the period of pregnancy, delivery and postnatal period, 'risk child' is under frequent control of neuropediatricians, psychologists and speech pathologists, so that possible development differences in all segments, including speech and language development, are observed in time. Information so obtained can give a partial answer to complex etiological component of stuttering, later on extended and supplemented with new information and insights.

Every one of us represents a combination of genetic and syngenetic program (Guntern 1980). Between genetic and syngenetic program there are medical, or rather neurorisk factors which can create 'fertile ground' for the occurrence of stuttering. Whether every risk child will develop a stutter depends on other factors and syngenetic program circumstances, as well (*Image 2.*).

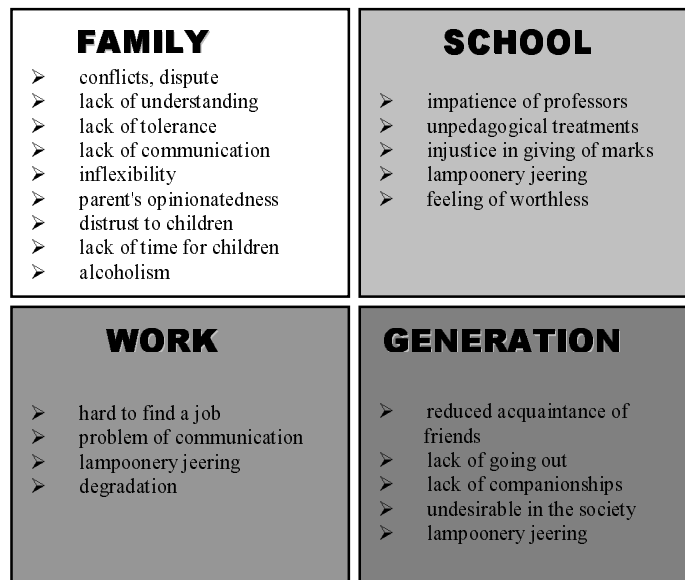
Image 2. Medical aspect of stuttering.



3.2. Aspect of interpersonal dynamics of stuttering

Interpersonal dynamics of stuttering refers to the analysis of the quality of human relationships in different natural settings: in family, at school, at work and among friends. Such information forms basic characteristics for the syngenetic program, which is basically everything experienced and imposed by education and upbringing. In a family context, for example, any too close a connection or a lack of the same between the members of the family can be one of the frequent provocative and maintaining factors of stuttering. The degree of quality of interpersonal relationships in relevant natural settings is an important insight for the analysis of occurrence and duration of stuttering, but also an important component for a possible correction during and after the therapy procedure. In the way they work (intensity and duration of stress factors) disturbed interpersonal relationships in a family or at school can be the main etiological factor for the occurrence of stuttering on already 'fertile ground', or a maintaining factor of stuttering at work (*Image 3.*).

Image 3. Interpersonal dynamics of stuttering aspect.



3.3. Aspect of individual psychodynamics of stuttering

Individual psychodynamics of stuttering refers to the analysis and testing of every patient's emotional dynamics before the therapy, so as to obtain an insight into the emotional distribution/dynamics. On the basis of the information obtained, the strategy of therapy is planned. It has already been mentioned that the main characteristic of patients stutterers is high anxiety, that is, dominant emotions of fear and caution sprung from the problems in interpersonal communication and relationships (Ozimec/Novosel 1985). Any unsuccessful communication is a failure, sometimes even a trauma. It is an everyday experience which is being internalised. Any bad experience which is internalised and not verbalised becomes everyday anguish and the subject of negative thinking. Long-term battle against stuttering reduces a person to a state of chronic exhaustion and negative emotional distribution. Our thoughts are then dominated by negative connotations of any given subject, while the unconscious and irrational dictates our behaviour.

3.4. Aspect of physiology of stuttering

Physiology of stuttering involves various measurements (pulse, blood pressure, photoplethysmography, sonogram, time of phonation, respiration, EMG, etc.) in the context of particular systems of the complex speech and language mechanism, and in order to establish the changes in prephonatory, phonatory and postphonatory phase. All the physiological changes

are important parameters for getting an insight into the whole background of stuttering, because some of them, due to their strong emotional effect, influence directly or indirectly the intensity of stuttering and side-manifestations. These physiological changes are often invisible, but they are an important factor in determining the intensity of stuttering.

All four aspects through which VaLMod considers stuttering are interrelated and influence each other. Leaving aside all the depths and complexities of etiology (neurophysiology, electrophysiology, biochemistry, etc.) and based on our research, the following assumptions may be formed:

- genetically burdened children, children suffering from intra-uterine stress, children with risk factors in prenatal, perinatal and postnatal period are more often prone to various and manifold development disorders, including stuttering;
- the quality of interpersonal dynamics in and out of the family context is an important component for the development of a healthy personality. Any occurrence of negative interpersonal relationships and persistent tensions is a cause for loud reaction on emotional and physiological level with risk children, due to their sensibility, and given the 'fertile ground' it can provoke and later maintain stuttering;
- long-term exposure to low-quality interpersonal relationships in family, at school or at work, in time leads to emotional and autonomous exhaustion resulting in negative emotional fund domination and different symptomatology in verbal and non-verbal behaviour;
- such an emotional state, dominated primarily by emotions of fear and caution, results in significant changes of speech physiology, namely, in disturbance on the relation 'emotional dynamics – speech physiology', followed by reversible changes in cardiovascular, nervous, endocrine, muscle, respiratory and other systems.

Previously mentioned research and experience poses the following questions:

- Is there a neurological basis to stuttering?
- Is stuttering a neurosis?
- Is stuttering an emotional disorder?
- Is stuttering a problem of interpersonal communication?
- Is stuttering a problem in creating new interpersonal relationships?
- Does stuttering present a problem in choosing a profession and job?
- Is stuttering a result of complex speech physiology disorder?

We believe that the answer to these and many other questions can be affirmative. Due to this very etiological complexity, the conception of VaLMod program is more directed towards quality and multidimensional approach in diagnostic, as well as in therapeutic segment (Novosel/Novosel 1997).

4. THERAPY OF STUTTERING

VaLMod program is a holistic and self-regulatory program incorporating a variety of techniques and procedures in the therapy of stuttering, only a few of which are mentioned here:

- relaxation
- self-suggestion
- respirational and phonatory training
- myofunctional exercises with coarticulation
- EMG biofeedback with regulation of muscle dynamics through prephonatory, phonatory and postphonatory phase
- intensive interpersonal communication
- corrective and educational work with members of the family.

Each of the above-mentioned techniques and procedures has an elaborate strategy and well-defined goals to be achieved in accordance with therapy dynamics.

One should point out that the essence of VaLMod program is the EMG biofeedback technique with regulation of muscle dynamics through prephonatory, phonatory and postphonatory phase, but in a variety that is totally different from the standard one (Novosel/Ribić 1994).

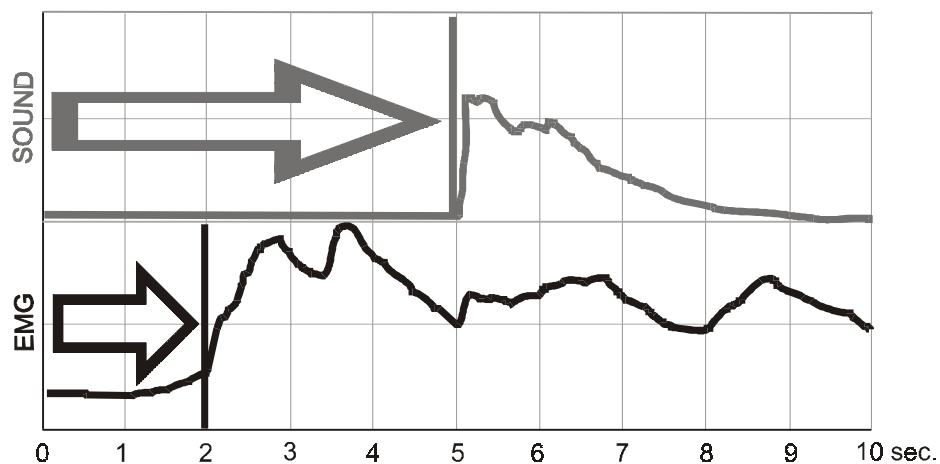
From emotional and physiological chaos to polyvalent psychogenic symptomatology in verbal and non-verbal behaviour, the objective of VaLMod program is primarily to establish emotional and physiological conditions for the vocal and motor realisation, which is accomplished through development and formation of feedback as the basic factor of stability in every system (Novosel, D. 1992b, 1994).

As a self-regulatory technique, EMG biofeedback records, analyses and outlines the integrated muscle potential by using a special Ghetaudus 161 biofeedback instrument, program and computer backing in the range of the vocal and speech, muscular and respiratory systems. Along with other techniques and procedures it consciously contributes to stabilising one or more active systems of the speech mechanism. In other words, the data are meant to be recognised by patients so that they can learn how to control their normally unconscious activities.

One of the biggest advantages of biofeedback is the fact that problems get solved in a natural way, with the main accent being put on patients so as to make them aware of their capacity to control a wide range of physiological processes (Novosel, D. 1990).

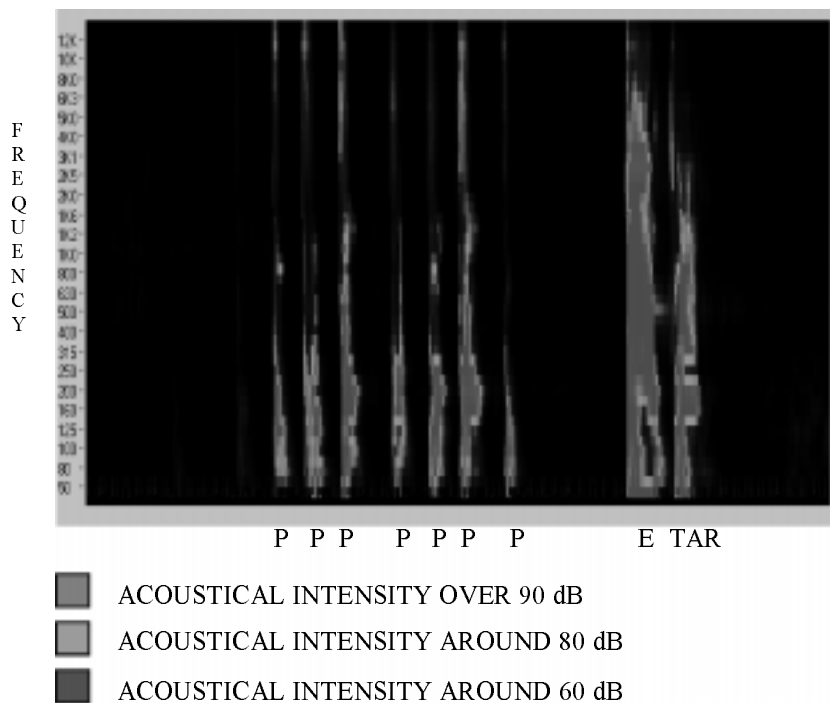
In the case of a patient suffering from intensive stuttering before the therapy started, a higher level of muscle tension in the laryngeal zone (spasm) taking place for up to three seconds before the first spoken word, that is, before speaking starts, was noticed, which can be seen in *Image 4* (Novosel, D. 1995, 1996). Statistical analysis has established an important correlation between the intensity and duration of muscle contraction in the prephonatory phase in relation to the intensity of stuttering (Novosel, D. 1990).

Image 4. Acoustical registration and EMG – biofeedback before the therapy.



Measuring acoustical intensity by means of a spectral analyser has shown that speech is characterised by an increased level of emotional and energetic charge, which results in a higher acoustical intensity exceeding 90 dB (*Image 5*).

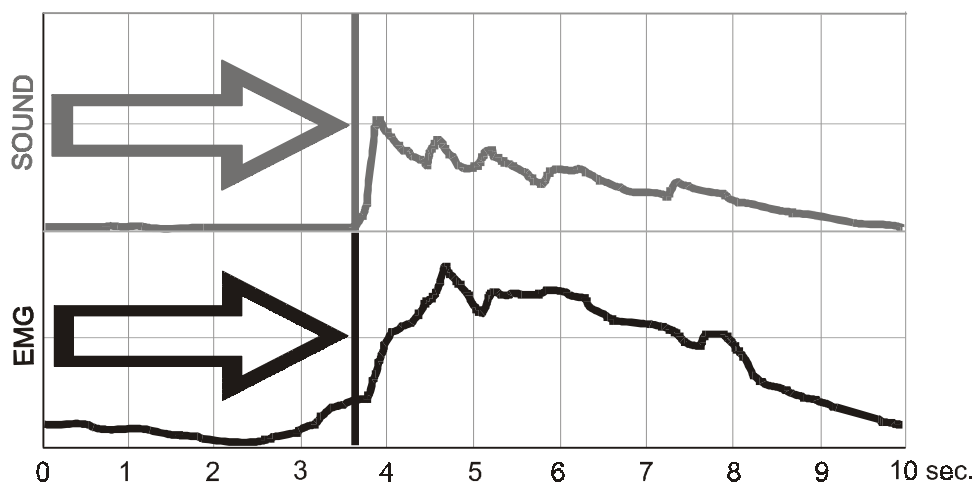
Image 5. Acoustical intensity of speech before the therapy.



After a few days' intensive therapy the acoustical speech signal and muscle dynamics can be synchronised to a satisfactory degree. In *Image 6*, it can be observed that there is no muscle con-

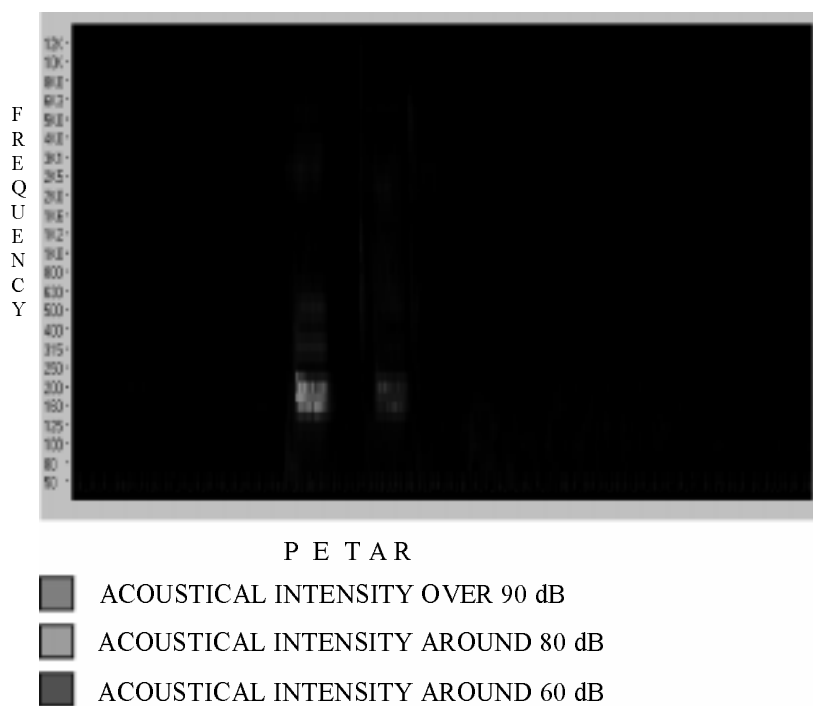
traction before the moment of speaking, the muscles in the laryngeal zone are activated simultaneously as words are pronounced. These corrections, along with some other arising in the segment of respiration, phonation and coarticulation lead to satisfactory speech fluency.

Image 6. Acoustical registration and EMG – biofeedback after the therapy.



The spectral analyser records the speech intensity at ca. 60 dB, which is within normal limits (Image 7.).

Image 7. Acoustical intensity of speech after the therapy.



In the course of therapy optimum physiological conditions enabling a more fluent speech realisation tend to be obtained. In view of that, correction is initiated on the plane of SPEECH PHYSIOLOGY, which includes respirational and phonatory training, myofunctional exercises with coarticulation assisted by a special computer program and instrument, as well as EMG biofeedback technique. Improved speech fluency initiates certain positive changes on the emotional plane, so that anxiety and fear gradually decrease, whereas joy and spontaneity are on the increase. Once these new conditions have been obtained and are consciously controlled, one can proceed to the main phase in which the ability of the accomplished emotional and physiological balance to be maintained is checked. This means direct INTERPERSONAL COMMUNICATION with unknown people in the street, agencies, shops and telephone calls.

VaLMod program therapy is administered in General Hospital in Varaždin throughout 12 days, 15 hours a day. Owing to complexity of both stuttering and the program itself, patients aged 14–60 are included in the therapy.

At the end of it, CORRECTIVE AND EDUCATIONAL WORK with *parents*, family members and spouses occurs, which can be considered the most difficult segment of the program. What makes it so difficult? After a 12-days' intensive therapy in General Hospital in Varaždin, the patient returns to their natural systems (family, school, college, workplace) where stuttering arose in the first place and, for some reason, persisted for years.

Each member of the family should know that this natural system can function adequately and has to do so, which things need to be changed, who needs to be changed and for what reasons, how communication can be improved, bearing in mind mutual adjustments that have to be made in order to obtain conditions for maintaining the emotional and physiological balance consistently, without which speech fluency, satisfying interpersonal relations and communication are not possible. Among 70 variables against which quality and dynamics of interpersonal family relations are measured, only a few problems that our patients are likely to face will be pointed out.

When asked with whom they can openly discuss about stuttering and other problems, out of 156 patients of both sexes, aged 10 to 48, 64% answered with '*both parents*', 22% '*with mother only*', 7% '*with a sibling*' and almost less than 1% '*with father only*' (*Chart 11*). *Chart 12* shows the frequency of these talks in which the '*occasional*' category predominates.

Chart 11.

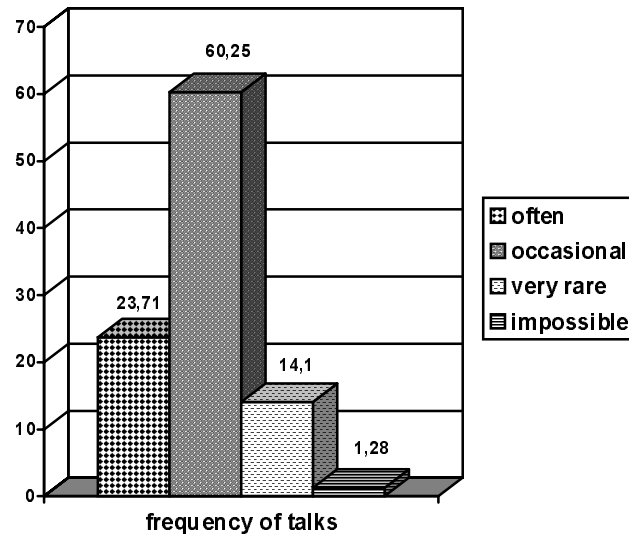
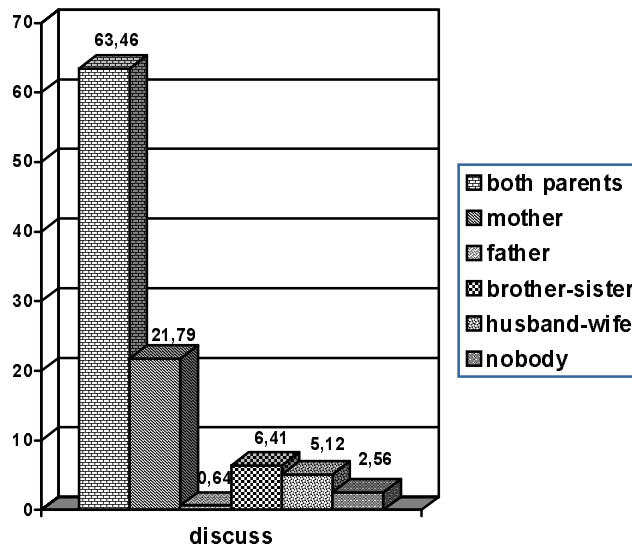


Chart 12.



When asked whom they trust most within the family, 56% said they trust *both parents*, 28% trust *only their mother*, even fewer trust a *sibling* and only 3% their *father* (Chart 13.).

Chart 13.

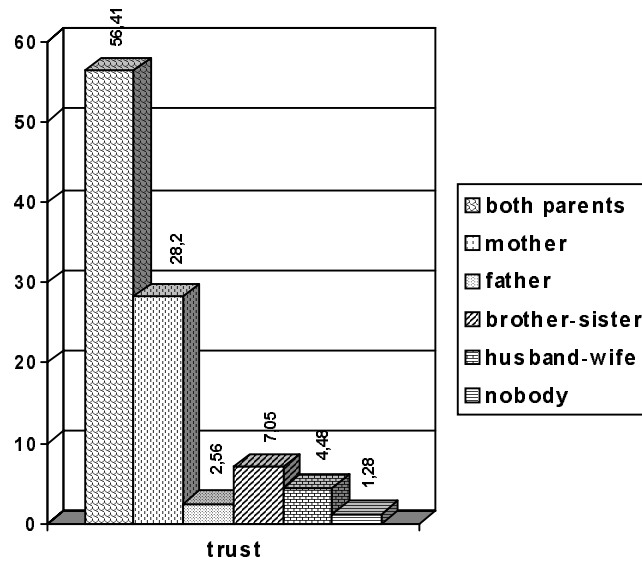
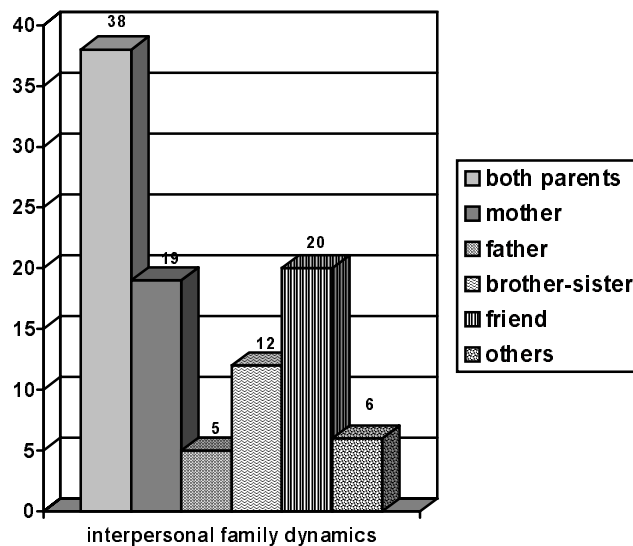


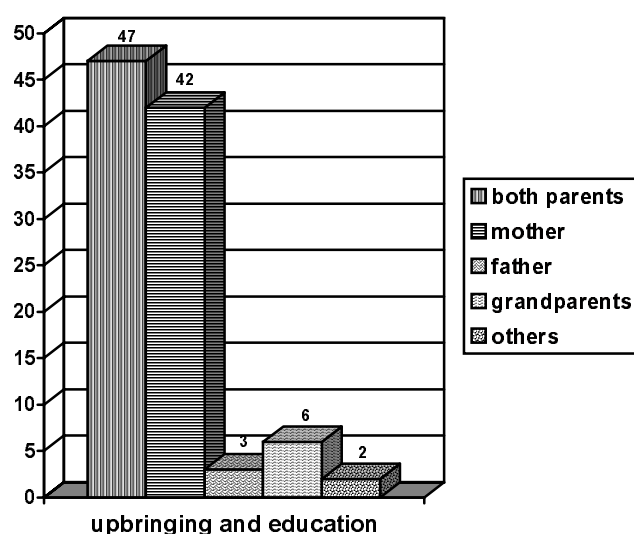
Chart 14.



When asked who they would turn to for help or advice if faced with an important problem, 38% of those examined would talk to *both parents*. About 20% of them would look for help and advice outside the family, talking to *friends* rather than their *mother* (19%). 12% would turn to their *siblings*, whereas only 5% would ask their *father* for help or advice (Chart 14.).

The question about who, in their opinion, has played a more important role in their upbringing and education throughout their lives, has given the following interesting results: an almost equal number is related to upbringing in which *both parents* have taken part (47%) and that in which only the *mother* has done so (42%), 6% is related to upbringing supported by *grandparents* and only 3% to that in which only the *father* has taken part (*Chart 15.*).

Chart 15.



5. THERAPY RESULTS

So far over 2500 patients have been included in VaLMod program. According to statistic parameters it can be concluded that 70% of our patients end their therapy with success, whereas the other 30% manage to reduce stuttering by only 50% (Novosel/Brestovci/Prizl 1993).

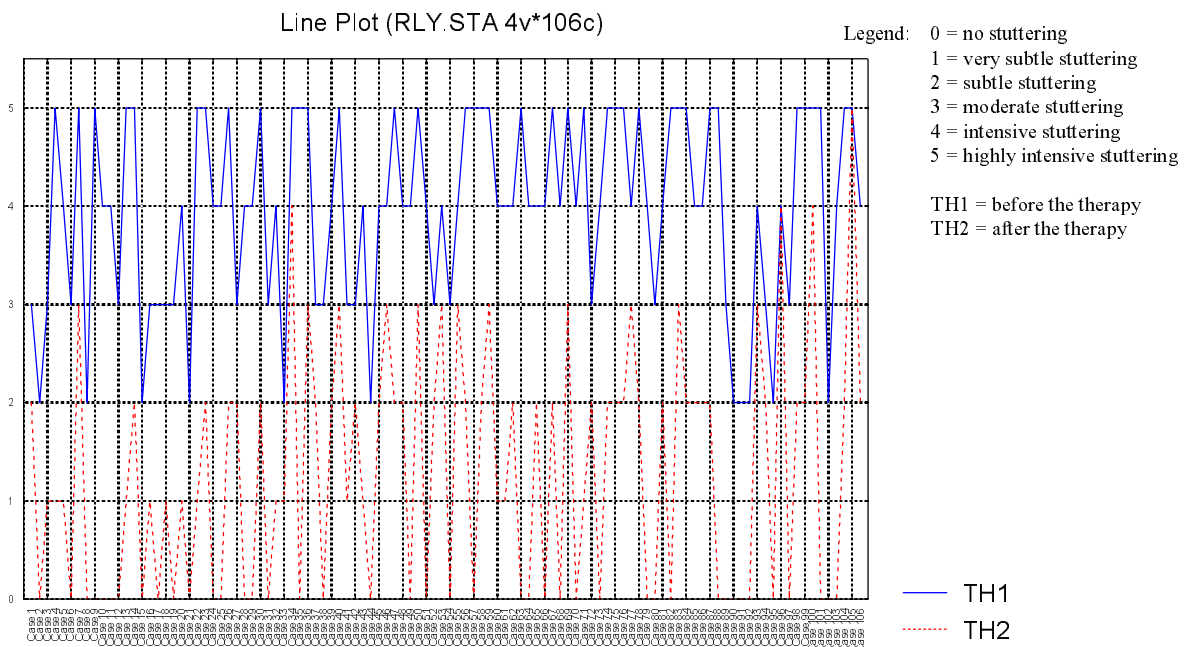
The criteria for quality and evaluation of speech fluency at the end of therapy are extremely strict and they apply to different conditions of speech and communication in which variables are evaluated:

- Fluency level in a monologue in mother tongue (discourse)
- Fluency level in a dialogue with unknown collocutors
- Fluency level in reading in the mother tongue and in a foreign language
- Fluency level in communication on the telephone
- Fluency level in schoolchildren upon being examined
- Fluency level in telephone conversations with former patients
- Fluency level in lectures
- Fluency level in front of the video camera during the final recording.

The expert team evaluates and assigns points to all the variables which finally leads to a conclusion about therapy results. It needs to be mentioned that each individual is not only self-evaluated but also discussed on the part of the group which makes conclusions about the results achieved.

Here is a brief outline of results achieved in VaLMod program therapy on the sample of 106 patients, 80 men and 26 women, aged 16 to 43, who received therapy in the first six months of 1999 (*Chart 16.*).

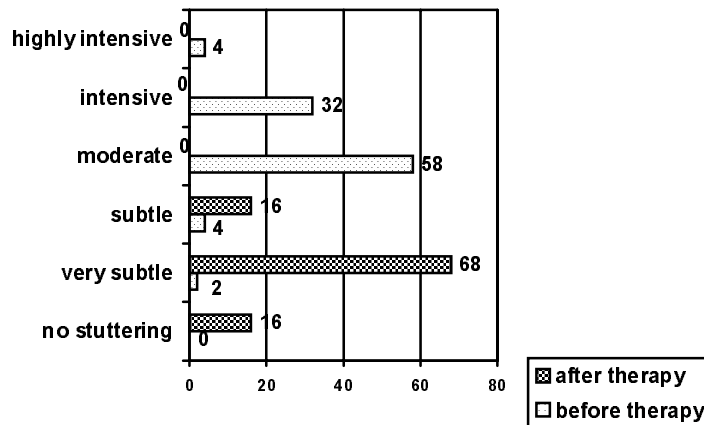
Chart 16.



It can be stated that the differences in results obtained by measuring the intensity of stuttering by means of the test for evaluating stuttering intensity (Riley 1972) before and after therapy are not only statistically significant but also on average tend to be six times less pronounced in the second measuring.

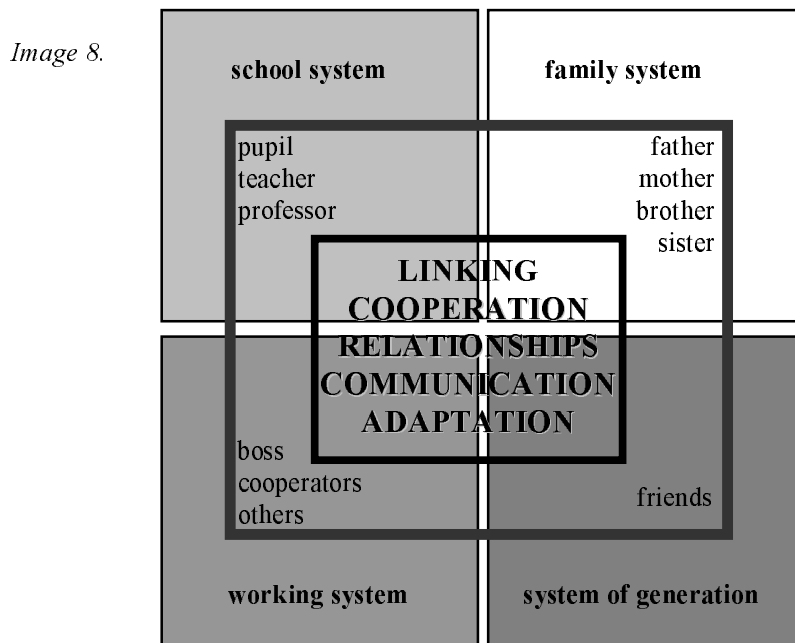
Comparative analysis of self-evaluation of stuttering in 50 patients of both sexes, aged 12 to 39, before and after the VaLMod program therapy has shown that there is a considerable difference in self-evaluation of stuttering, which speaks in favour of therapy efficiency (Pizek 1998).

Chart 17.



After 12 days, the ambulatory therapy is continued within the framework of natural systems and goes on under our supervision for up to at least one year.

It should be emphasised that VaLMod program is not only a program to be applied in therapy of stuttering and dysphonia. Owing to its multidimensional approach and therapy aimed at creating and maintaining the inner balance and physiology as a whole, it is above all a program for successful, accomplished and happy life (*Image 8.*).



It is a program for everyone, since within natural systems an optimal cohesion, cooperation, relations, communication and mutual adjustment have been established.

VaLMod program has received a gold medal in the field of medicine at the 23rd International invention fair Geneva 1995, at the International invention fair IENNA at Nürnberg it received a gold medal for the scientific concept and the results achieved in the stuttering therapy and a gold medal at INPEX XIX International invention fair in Pittsburgh 1998 in the field of therapeutic.

6. BIBLIOGRAPHY

- Beaty, D.T. 1980 A multimodel approach to elimination of Stuttering, *Perceptual and Motor Skills* 50: 51–55.
- Detoni, J./Novosel, D. 1989 Razina simpatičkog vegetativnog tonusa u osoba koje mucaju praćena mjerenjem pulsa i perifernom fotopletizmografijom, *Defektologija* 25/1: 107–117.
- Eccles, J.C./Zeier, H. 1984 *Gehirn und Geist*, Frankfurt a.M.
- Freeman, F.J. 1985 Laryngeal muscle activity of Stutterers, in: Curlee, R.F./Perkins, W.H. (eds.) *Nature of Treatment of Stuttering, New directions*, London/Philadelphia.
- Guntern, G. 1980 Das sybgenetische Programm und seine Rolle in der Verhaltenssteuerung, in: Duss-von Werdt, J. (Hg.) *Der Familienmensch*, Stuttgart: 97ff.
- Ham, R. 1986 *Techniques of Stuttering Therapy*, Englewood Cliffs, New Jersey.
- Hanna, R./Wilfing, F./McNeill, B. 1975 A biofeedback treatment for stuttering, *Journal of Speech and Hearing Disorders* 40: 270–273.
- Kalotkin, M./Manschreck, T./O'Brien, D. 1979 Electromyographic tension levels in stutterers and normal speakers, *Perceptual and Motor Skills* 49: 109–110.
- Novosel, D. 1982a *Komparativna EEG analiza u djece koja mucaju*, Magistarski rad, Medicinski fakultet Sveučilišta u Zagrebu.
- 1982b Zastupljenost rizičnih faktora u djece koja mucaju, *Acta medicorum* 8: 37.
- 1990 *Elektromiografska biološko-povratna veza i mucanje*, Disertacija, Fakultet za defektologiju Sveučilišta u Zagrebu.
- 1992a Mucanje i razina napetosti mišića larinksa, *Defektologija* 28/1–2.
- 1992b *Povezanost razine napetosti mišića larinksa i jakosti mucanja*, Znanstveni skup, Istraživanja na području defektologije, Zagreb.
- 1994 *EMG biofeedback and stuttering*, Sprache – Therapie – Computer, I. Internationaler Kongress, Graz.
- 1995 EMG biofeedback and stuttering – a special review of integrated muscular potentials, *Logopedija* 1/1–2.
- 1996 Results of the VaLMod Programme Application of EMG in the Therapy of Stuttering, in: Novosel, D./Roth, M. (eds.) *VaLMod & Modakt zur com-*

- puterunterstützten systemischen Therapie von Sprech-/Sprachstörungen, Konstanz.*
- Novosel, D./Brestovci, B. 1988 Neke relacije između mucanja i elektroencefalografskih nalaza, *Acta defectologica* 6/1–2: 45–60.
- Novosel, D./Brestovci, B./Prizl, T.
1993 *Praćenje nekih parametara u terapiji mucanja kroz program EMG biološko povratne veze*, Multidisciplinarni pristup v logopediji, 4. strokovno srečanje logopedov Slovenije, Portorož.
- Novosel, D./Novosel, T. 1997 VaLMod program – multidimenzionalni pristup dijagnostici i terapiji mucanja, *Acta Medicorum* 23/1–2.
- Novosel, D./Novosel, T./Novosel, I.
1999 *Mucanje i vrijeme trajanja kontrakcije mišića larinksa*, Zbornik radova, 6. strokovno srečanje logopedov Slovenije, Nova Gorica.
- Novosel, D./Ribić, Z. 1984 Neka iskustva u primjeni EMG biološko povratne veze u terapiji mucanja, *Defektologija* 20/1–2: 83–86.
- 1985 *Primjena kineziološke EMG biološko povratne veze u tretmanu mucanja*, Zbornik radova I. Kongresa logopeda Jugoslavije, Opatija.
- 1986 *Aparatura za EMG biološko povratnu vezu kod terapije mucanja*, XXX Konferencija ETAN-a, Herceg Novi.
- 1994 *VALMOND program*, I. Kongres logopeda Hrvatske, Varaždin.
- Novosel, T. 1996 *Mucanje i vrijeme trajanja kontrakcije mišića larinksa*, Diplomski rad, Fakultet za defektologiju Sveučilišta u Zagrebu.
- Ozimec, S./Novosel, D. 1985 Emocionalna struktura i dinamika u djece koja mucaju i neke indikacije za terapiju, *Defektološka teorija i praksa* 1–2.
- Peters, H.F.M./Hulstijn, W./Starkweather, C.W.
1989 Acoustic and Physiological reaction times of Stutterers and Nonstutterers, *Journal of Speech and Hearing Research* 32: 668–680.
- Pizek, K. 1998 *Komparativna analiza procjene jakosti mucanja*, Diplomski rad, Edukacijsko-rehabilitacijski fakultet Sveučilišta u Zagrebu.
- Riley, G.D. 1972 A stuttering severity instrument for children and adults, *Journal of Speech and Hearing Disorders* 37: 314–321.

Dr. Darko Novosel, Prof. Speech Pathologist

Tatjana Novosel, Prof. Speech Pathologist

Ingrid Novosel, M.D.

General Hospital

Speech and Hearing Rehabilitation Activities

Varaždin, Croatia