4th Meeting on Impact Biomechanics, organised by Centro Zaragoza

The "4th Meeting on Impact Biomechanics" took place on the 27th of September at the Campus of the University of Zaragoza. The meeting commenced with a presentation by David Casademont, president of the organising entity, the Centro Zaragoza, to introduce the speakers and the papers to be given by them.

José Antonio Badillo Arias - Regional Representative in Madrid, CCS.
Pedro Benítez Pizarro - Senior Expert at the Subdirectorate for the Coordination of Regional Branches, CCS.
Daniel Hernández Burriel - Regional Representative in Aragon, CCS.
Ismael López Sanz - Senior Expert at the Subdirectorate for Expertise, CCS.
Nuria Plaza Martínez - Expert at the Subdirectorate for Operations, CCS.

Biomechanics as a Road Traffic Accident Research Tool (Carlos Arregui, Director General of Centro Zaragoza)

The first paper was given by Carlos Arregui, whose professional life has been centred on biomechanical research. The paper addressed the capacities and the potential of biomechanics as a tool from the perspective of a combination of different disciplines (engineering, biology, physics and medicine).

The academic definition of impact biomechanics would be the study of the response of the human body to the forces acting on it, although for the speaker, reference should also be made to a science, associated with medicine and engineering, where it is inevitable to use language in terms of probability, but taking into account that the mission of impact biomechanics is not to diagnose injuries or to treat them. What it can do is define the mechanisms of an injury, quantify the response of the human body and determine the injury threshold.

For this, we need to have data obtained through experimentation and tests, to avoid complex mathematical calculations. The tools available are as follows: characterisation of biological materials, accident research, dynamic analyses, mathematical models, use of volunteers, use of animal models and use of corpses.

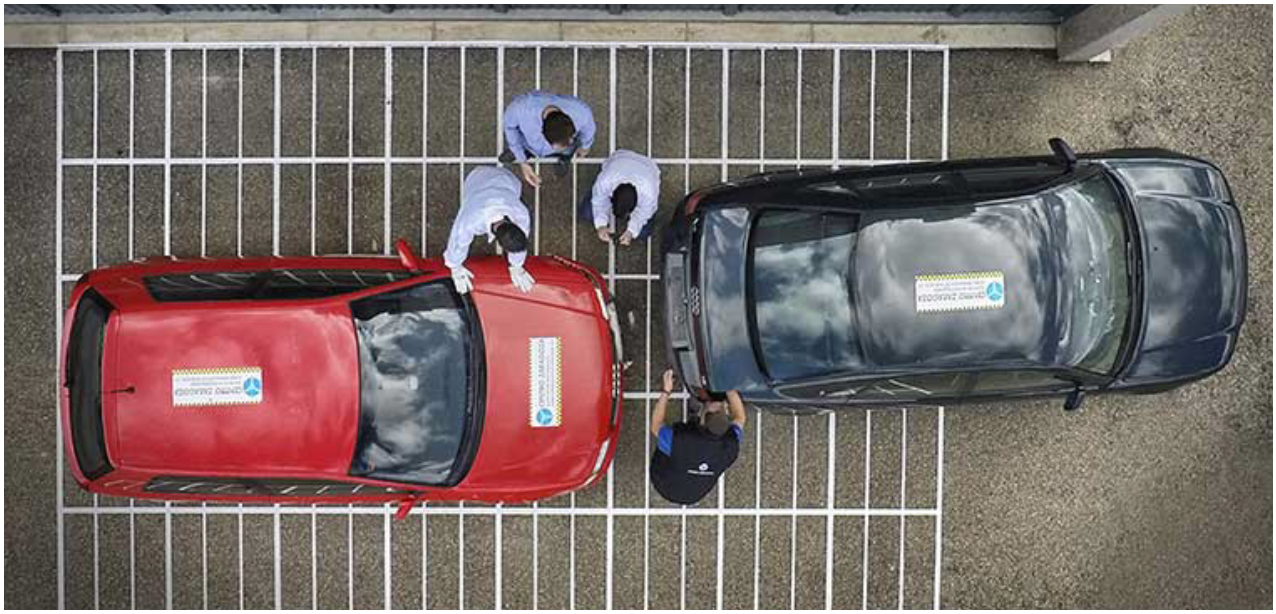
Evidently, the requirements and protocols of use of these tools are not the same, although all of them are aimed at obtaining an injury probability curve in relation to a physical parameter or a biomechanical criterion.

For Carlos Arregui, Director General of Centro Zaragoza, impact biomechanics serves to determine how injuries occur. Mathematical equations are useful but very complex. For this, experimental approximation and knowledge of scientific literature are the best strategies.

Juan Luis de Miguel, Deputy Director of Centro Zaragoza, pointed out that high-intensity impacts are easy to measure, since tools exist to enable such measurement. This is not the case with low-intensity impacts, although there was not much demand for measuring these impacts prior to the change in legislation. In his opinion, the best way to address low-intensity impacts is the experimental approach. You have to be sceptical about the theoretical models.con los modelos teóricos.

He then went on to describe several practical cases in which impact biomechanics was capable of confirming and demonstrating the following: that the excess load of a trailer had no influence as a cause of death of a pedestrian; that the sudden braking of a car to avoid running over a cyclist did not cause the fracture of the kneecap claimed by the front seat passenger of the car; and whether a person struck by a vehicle had the status of a pedestrian or of a driver of a minibike.

For Arregui, impact biomechanics serves to determine how injuries occur. Mathematical equations are useful but very complex. For this, experimental approximation and knowledge of scientific literature are the best strategies.



How Accident Victims' Associations View the Implementation of Act 35/2015 and Injury Biomechanics Reports (José Pérez, member of the Act 35/2015 Monitoring Committee)

The speaker began his exposition by making an initial assessment of Act 35/2015 from the point of view of the road traffic accident victims' associations. In this regard he highlighted both the virtues of the Act, as well as its defects and the aspects where caution should be exercised.

With respect to the positive aspects, he pointed out the following:

One of the main virtues of the new legislation is the level of compensation payments in the case of death. The speaker felt that a significant success had been achieved with the design of the new tables, the proper categorisation of the injury victims, the establishment of particular damages and the recognition of loss of income, among others. This has been highly satisfactory for the victims' associations, considering that we are now getting closer to adequate justice and full reparation of the damage.

Other virtues of the law to be underlined include the recognition of the expenses of future medical care and the Framework Agreement for the provision of this care in the sphere of the public healthcare system, since it is considered very positive that the public system should have instruments for recovering the cost of the medical care it must provide, although it is also true that there is scope to think about improving it. For example, the speaker asked himself: what happens when who has to meet those future expenses are the employers' mutual funds?, and if the injury victim is a foreign citizen?, and what happens if the injury victim chooses private healthcare? Despite the fact that these questions need to be given an answer, the current regulation is considered very positive.

Another positive aspect is the possibility given by the Act, on as many as three occasions (articles 88.3, 125.6 and 132.4), to have recourse to an actuary in order to verify whether the public pensions to which a victim is entitled are different from those initially estimated by the tables, particularly in the case of self-employed workers. Nevertheless, the speaker considered that the Act should have allowed this possibility on a larger number of occasions.

A major advance achieved by the Act is in relation to the regulation of future prostheses and orthoses, although it would be necessary to revise the replacement periods established on Table TT3, as well as the limit set at 50,000 € per replacement.

The speaker also highlighted the preamble of the Act as, despite the fact that it does not have the force of Law, it does set out the principles which are to prevail for interpreting the text, even though it appears that the principle of full reparation of damages is not very coherent with the quantitative limits progressively established as the Act unfolds.

In terms of the negative points or defects in the Act, Mr. Pérez referred to the following:

One of the first defects to be pointed out in the reform is the enactment of Royal Decree 1148/2015, regulating the issuance of expert reports by the Legal Medicine and Forensic Science Institutes at the request of private individuals, in extrajudicial claims relating to motor vehicle events. This is a rule designed to settle the discrepancies and controversies that can arise between injury victims and insurance undertakings but which has not as yet achieved its objective, since some forensic doctors are generating even more controversy in the sense that, in the face of two differing evaluations of injuries (that of the insurance undertaking and that of the injury victim), they are making evaluations even below the assessment of the undertaking. This position, taken by some forensic doctors, is interpreted by the injury victims as an obstacle and not as a channel for settling controversies in the evaluation of bodily injury.

Another defect referred to by the speaker, and which is also a concern of the victims' associations, is the noncompliance with the provision made in Article 37 of the Act with respect to the medical reports and the provision of such reports to the injury victims without passing through the prior filter of the insurance undertaking. This procedure generates uncertainty as to whether a single final report exists or not, with respect to the absolute impartiality of the evaluator or whether the person who scores the sequelae is the medical expert or a third party. Without a doubt, this point should be addressed by the Monitoring Committee for overseeing application of the scale at its next meetings, to ensure that the report delivered by the medical expert to the injury victim is the same as the one given to the insurance undertaking, meaning that it must be an exact copy and delivered within stricter time limits.

Another significant negative aspect of the Act is the regulation of loss of income for victims who are dedicated to household tasks. The 25% increase recognised by the Act is not very coherent: why that amount and not another? The victims' associations consider that this was not an adequate arrangement and that it should be adjusted by means of a specific table for these victims. Likewise, the speaker emphasised that the limit established in Article 143.4 of the Act should be eliminated: why fix a limit of one monthly payment? These two points, which affect the victims dedicated to household tasks, in Mr. Pérez's opinion, could end up before the Constitutional Court if measures are not taken to remedy them.

Another of the negative issues to be highlighted is the provision contained in Article 7.8 of the Act, which obliges the injury victim to submit a prior claim to the insurance undertaking before having recourse to the judicial channel. The victims' associations are surprised to find that insurance undertakings are attributed a status similar to that of the Public Administration, as well as the fact that the article only includes obligations prior to filing suit to be met by the injury victim and not by the insurance undertaking.

They perceive a lack of reciprocity in the rule: and if the insurance undertaking does not have a medical evaluation performed in the extrajudicial stage and does not take measures intended to compensate the injury victim? In this regard, the speaker noted that consideration is being given as to whether the legislation should expressly indicate that the evidence requested or submitted by the insurance undertaking in the judicial stage will not be admitted for

processing if such evidence –medical report for evaluating the injury– could have been obtained in the extrajudicial stage. This position is already being taken by a number of courts: specifically the Provincial Court of Granada has refused to admit evidence requested by an insurance undertaking, because such evidence could and should have been taken in the prior extrajudicial stage. The associations have taken the position that, since the injury victim is required to meet prior formal obligations, such requirement should also be applied to the insurance undertaking, considering that both parties have the same arms to defend themselves. During the round table discussion held at the end of the meeting, this position was criticised by the Prosecutor who was in attendance on considering that this would be contrary to effective judicial protection.

As a final negative point, the speaker referred to the index for updating income and compensation amounts. In this regard, he noted that in the draft law agreed among the members of the Expert Committee, the Consumer Price Index (CPI) was taken as the reference index, although, after the legislation was referred to the Congress of Deputies, this was replaced by the index for the revision of pensions. The associations consider that an urgent reform is necessary on this point in order to recover the CPI as the reference index.

With respect to a number of points affecting the scale, the speaker felt that a degree of caution needs to be exercised and noted the following:

- Revision of the decriminalisation of misdemeanours, since it is being shown that this was a mistake, on failing to achieve the desired effects.
- Possibility of the reinstatement of the writ of maximum amount, which was a very useful instrument for injury victims and provided a situation of preference with respect to the insurance undertakings.
- Creation of a new automobile civil suit.
- Achieve the reciprocity of obligations in Article 7.8 of the Act.
- Is the minimum wage sufficient? Raising it to one and a half times is being considered.
- Revision of the hours considered necessary to have help by a third person.
- Why is exceptional injury not recognised for temporary injury victims?
- Free choice of medical institution given to the victims.

With respect to the biomechanics reports, the speaker underlined that it is important to make a professional and adequate use of such reports. The associations are in favour of these reports, provided that they are rigorously prepared, with quality and for the specific case concerned, eliminating generalities. For this purpose, the reports need to be based on reliable data. If this is not the case, the result obtained will be a mere opinion, and not a report sufficient for disproving the injuries claimed. Such data call for the professional work of the law enforcement agencies, which must draw up full accident reports and not merely sketch an outline of how the accident occurred and little more. In this regard, Mr. Pérez believes that the decriminalisation of misdemeanours has contaminated the entire process, generating an enormous amount of biomechanics reports submitted for disproving the claims lodged on account of minor spinal injuries. These reports, which are sometimes limited to indicating on a single page that the risk is nil, only serve to detract from the prestige of biomechanics and consequently, that of the insurance companies choosing to use these biomechanics reports abusively.

Biomechanics Reports. Medical Criteria (María José García, medical consultant, Zurich Insurance PLC)

Dr García pointed out that biomechanics reports give an idea of the intensity of a collision of vehicles and of the seriousness of the injuries of all of the occupants. Insurance undertakings are unanimous in referring to those reports intended to determine intensity in low-intensity collisions with minimal material damage as biomechanics reports, both the reports made by a medical expert as well as those prepared by an engineer.

The lecture was centred on low-intensity collisions, and the most frequent injury mentioned was "whiplash". The speaker noted that collisions of this type awakened significant interest on an international scale. Comparing data obtained by Tirea on the national level, 22.23% of these injury victims will report these symptoms chronically; that is, they will present sequelae, while international studies indicate that less than 10% will experience chronification. Therefore, according to this information, we are 12 points above what scientific research indicates internationally.

The whiplash module was introduced for the first time in the Private Clinic Healthcare Agreement 2008-2009 for Hospital Groups I and II, while in the Agreement for 2011-2012, the medical centres in Group C were included. There have been changes since then, but these have been introduced for modifying prices, diagnostic tests and the like, although the module has remained intact up to the Agreement that we have today.

When evaluating injury victims, we begin to see other injuries accompanying the whiplash in nearby areas, but not in the spine, such as the elbow or wrist, as well as vertigo, dizziness or jaw clicking.

For the speaker, the biomechanics report prepared by a medical expert should serve to compile all of the medical information on the injury victim: physical exploration and diagnosis, evaluation of diagnostic tests, study of medical documentation submitted by the patient, scientific bibliography, including the protocols existing in this regard for establishing a valuation guideline.

The biomechanics medical report –she added–, must be accompanied by numerical information, such as the engineer's biomechanics report, information on the material damage to the vehicles involved and police reports. It should also determine the injuries, sequelae and recovery period attributable to the accident in question, by using medico-legal causality criteria for establishing the causal link, which are as follows:

- Causality criteria: diagnostic probability criterion; that is, it is necessary to establish whether the mechanism of possible anatomical or physiological production is likely, and this should be based on a physiopathological reasoning that explains and makes it possible to understand the reason why.
- Symptomatic continuity: establishes the presence of symptoms bridging the gap between the first clinical manifestations and the final injury. This is verified with the medical history of the patient injured in the collision and evidence of medical visits and regular treatments.
- Topographical factor: consists of the existence of a relationship between the area of the body affected by the accident and the injury suffered, unless a pathogenic explanation indicates otherwise.
- Quantitative or intensity factor: relationship between the intensity of the damaging event and the intensity of the injury.
- Chronological criterion: consists of the symptoms appearing in a medically explainable time. It is supported on the experimental data and clinical observation.
- Prior completeness factor: absence or not of the previous status.
- Criterion of exclusion: consists of the fact that no other cause intervenes which would completely justify the pathology.

These 7 criteria normally translate into 4, as reflected in Act 35/2015: exclusion, chronological, topographical and intensity. This last factor should be the one best studied and defined in the engineer's biomechanics report, while the exclusion criterion should be the one most exhaustively analysed by the medical expert, since it is here where we can determine the influence of a previous condition of the injury victim on the final outcome: the famous concept of contributing cause.

In this way, the biomechanics report prepared by the medical expert should make the difference between the cause and the contributing cause clear. The cause is the indispensable requirement for producing the effect and the sufficiency of the effect for giving rise to the injury, while the contributing cause is an equally necessary condition but not sufficient of itself for producing the injury. It is defined as those circumstances or factors outside of the event

(low-intensity collision) but which aggravate its consequences, turning an injury which initially was minor into a serious injury, or what was not initially life-threatening into a fatal injury.

Dr. García stated that there are three types of contributing causes:

- Pre-existing: prior to the accident. These are elements or diseases which existed before the damaging event, and the effect has been changed, aggravating the injury, making it worse or accelerating it. Pre-existing conditions can be anatomical (congenital malformations) or pathological, severe or chronic (osteoporosis).
- Concomitant or simultaneous: two events coincided that influenced the occurrence of the injury.
- Supervening: added factors separate from the normal course of the injury. The final result of the injury is modified by the introduction of an event subsequent to the cause and unexpected. This concept is related to the complications and situations inherent to the treatment itself or the clinical course of the injury.

When an event or injury departs from what is usually the case, a separation must be delimited between the effects strictly related to the cause and the normal clinical course of the injury and the effects of the contributing cause.

In addition, the speaker referred to the problems medical experts encounter for determining the criteria of causality, which are as follows:

- The medical expert often enters the scene when the process has already finalised some time ago, with the difficulty involved for compiling the necessary data. This makes it difficult to determine the healing period.
- The injury victim can neither give consent for being examined nor provide the medical documentation.
- With the Organic Law on Data Protection (LOPD), it is difficult for the medical centres treating such patients to provide data, reports or even to arrange an interview with the medical professionals who took part in the treatment.
- Incomplete documentation (because it does not exist).
- It may not be possible to describe the pathology referenced in objective terms.
- On some occasions, specific academic training may be lacking.

To finalise, the speaker concluded as follows:

- The medical criteria in biomechanics reports must be medico-legal causality criteria.
- The ultimate mission is to establish the causal link between the injuries reported and the accident with which we are concerned.
- The causes and the contributing causes of the injuries (pre-existing, concomitant and supervening) must be clearly defined.
- Once the causal link has been determined, the medical report must specify the injuries derived from the accident, the healing period and the possible sequelae, if any.
- The medical experts who evaluate must have proper training.

The Importance of the Technical Investigation in Collision Analysis (Juan Luis de Miguel, Deputy Director of Centro Zaragoza)

The speaker pointed out that high-intensity impacts are easy to measure, since tools exist to enable such measurement. This is not the case with low-intensity impacts, although there was not much demand for measuring these impacts prior to the change in legislation. In his opinion, the best way to address low-intensity impacts is the experimental approach. You have to be sceptical about the theoretical models.

A number of tests have been performed in the methodology used by Centro Zaragoza, such as:

- Vehicle mass 1: 971 kg. Vehicle speed 1: 29 km/h.
- Vehicle mass 2: 1,176 kg. Vehicle speed 2: 16 km/h.

A side impact is involved (one vehicle pulls out into traffic and the other impacts it laterally). The acceleration measured is 0.5 g (less than in a braking manoeuvre). The claimants are the occupants of the vehicle impacting the other vehicle.

The conclusion reached is that the average acceleration is a better indicator than the increase in speed (Delta V) in order to see the possible injuries caused by the force of the collision. The injuries depend on the force of the impact and the prior personal characteristics of the injury victim, such as age, previous pathologies, etc.

Another important element is the direction of the impact. On a roundabout the crosswise acceleration is less than 0.6 g, while in side collisions the accelerations are lower.

According to the speaker, the most important parameters in a low-intensity collision are:

- Damage to vehicles: this does not need to be reviewed by the person making the report; this has to be done by the insurance loss adjuster, who will send the appraisal report, with photos, to the person performing the impact study.
- Increase in speed and average acceleration: depends very much on the collision time and the elasticity of the impact.

In terms of alternative ways to calculate the increase in speed, he pointed out the following:

- By measuring parameters such as extension, depth of the deformation, etc. It can sometimes be said that there are so many parameters that are invented that the result is distorted.
- Finite Element Method: this is not a good method for low intensity.
- Comparison with the Bumper Type-Approval Regulation (R42/1981):
  - It is usually argued that the Regulation indicates that bumpers must withstand impacts of 4 km/h without visible damage; even though the Regulation does not actually state this at any time. In addition, current bumpers have more functions that those existing in 1981, for example: aerodynamic, aesthetic, etc. functions. With very mild impacts, damage can occur at the present time (for example, to the paint).
  - Not all damage can be detected with the naked eye.
  - This Regulation is completely out of date, since vehicles have changed considerably. Moreover, the replacement rate is not the same for the various parts of the vehicle.

The speaker concluded by saying:

- The theoretical calculations do not coincide with the experimental results.
- By applying replacement rates, theoretical results are obtained that are different from the experimental outcomes.
- The experimental method is the best solution.
- Centro Zaragoza is performing ongoing tests to enrich its database and improve the results obtained.

Whiplash from the Perspective of Case-Law. The Courts and Article 135 of Act 35/2015 (Elena Agüero, Prosecutor in Examining Magistrate' Court No. 46 of Madrid)

The speaker began her paper by referring to the functions of the Public Prosecutor's Office in road traffic accidents, arguing that at the present time, following the decriminalisation of misdemeanours by Organic Law 1/2015, of 30 March, on the reform of the Penal Code, hardly any proceedings derived from road traffic accidents reach the examining magistrates' courts. She affirmed that, following this change, the majority of accidents are settled out-of-court and, in any case, in the civil and not the criminal jurisdiction, since the majority of offences have been decriminalised.

She noted that at the present time only serious negligence with the result of death or injuries and less serious negligence with the result of serious injuries or death are penalised as an offence. Consequently, all of the cases of minor negligence, of serious negligence with minor injuries (Art. 147.2, Penal Code) and less serious negligence with the result of minor injuries (Art. 147. 1 and 2, Penal Code) are decriminalised.

Although not many accidents arrive at the Examining Magistrates' Courts and, consequently, at the Public Prosecutor's Office, the most frequent cases are those in which a number of offences against road safety included in articles 379 et seq. of the Penal Code coincide, in addition to accidents with damages. Often these accidents occur under the influence of alcohol. In this regard, she issued a warning by way of two examples, that is, if someone drives in conditions of this kind, even though they might not be liable for the damages, they are always going to face one problem or another, since proceedings will be initiated for an offence against road safety.

On analysing Article 135 of Act 35/2015, the speaker indicated that this article introduced into the law the criteria of causality, now consolidated by the courts for determining the connection between a traffic accident and the injuries caused. For this purpose, both the natural causality as well as the legal must be taken into account, with the courts being responsible for evaluating the coincidence of causality criteria.

With respect to natural causality, the speaker asked herself whether a low-intensity accident could cause neck injuries. Referring to several judgements handed down by Provincial Courts, she noted that the courts emphasise that the absence of injuries in rear-end collisions with insignificant material damage cannot be taken as an "unquestionable fact", since in no way has the impossibility of the occurrence of neck injuries been medically proven. In this regard, she explained, the courts alert to the need to focus on an individualised examination of each of the injury victims and to assess the rest of the concurring circumstances. Particularly, the way in which the collision occurred –topographical factor–, the unexpectedness of the collision for the injury victims, their age or condition of health –criterion of exclusion– must all be taken into account.

She added that in low-intensity collisions, the lesser the degree of deformation of the vehicle, the greater the potential for the injury of the occupant, because when deformity occurs, this absorbs the energy of the collision.

With respect to the legal causality, attention must be given to the provision made in article 1 of the Act on civil liability and automobile insurance, which establishes that these damages and injuries can be attributed to the driver, due to the risk created in the driving of vehicles and, consequently, the driver will be liable, unless any of the legal reasons for exoneration (force majeure and the exclusive liability of the victim) can be alleged.

The speaker ended her paper by referring to a number of criticisms voiced by the courts concerning biomechanics reports. According to many judicial rulings, a biomechanics report cannot be considered as sufficient proof for concluding that the injuries objectively documented in the medical reports issued by the attending physician and the forensic report did not occur. She referred to the Judgement handed down by the Provincial Court of Valencia on 12 June 2015, which stated that "we are looking at mere theoretical studies on hypotheses and probabilities, while on the other side we have a person injured from the very first day when the accident took place, who has been treated by medical personnel with no subjective interest, and it appears that none of the professionals treating the patient noticed anything unusual in the description by the victim of how the injury occurred".

With respect to the relevant doctrine, quoting Larrosa Amante, she said that the principal shortcoming attributed to these reports stems from the fact that they do not take into consideration substantial aspects of the personal reality of the injury victims (age, medical history, weight, location inside the vehicle, position of the neck, musculature more or less developed in the area affected, etc.), factors which contribute to the occurrence of neck injuries. Although Article 135 does not enumerate these, it does recognise them when it states "and other variables affecting the likelihood of their existence".

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