How to assess an optimal blood ozonisation in Systemic Ozonized Autohaemotherapy: a bedside indicator

Amato De Monte

Struttura Operativa Regionale Emergenza Sanitaria Friuli Venezia Giulia

demonte54@yahoo.it

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Physician responsability in Systemic ozonized autohaemotherapy is totally different from a standard medical treatment

- correct indication
- accurate administration technique,
- **accuracy and precision of medical compound production**

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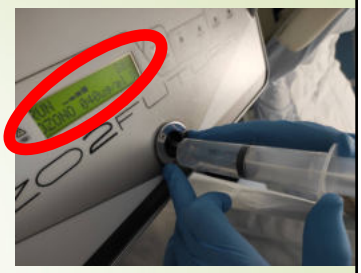
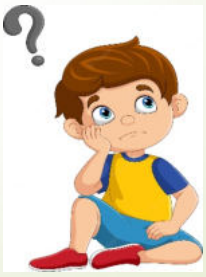
Scientific Societies recommend as mandatory a spectrophotometer in the O_3 generator



- no indication concerning time and modalities of blood/gas mixture mixing



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- Ozone represents the medical drug while pure oxygen is the carrier (Bocci)
- The medical effects of O_3 occurs only if it gets in contact with blood
- Bocci recommends 5 minutes of "gentle mixing" of collected blood

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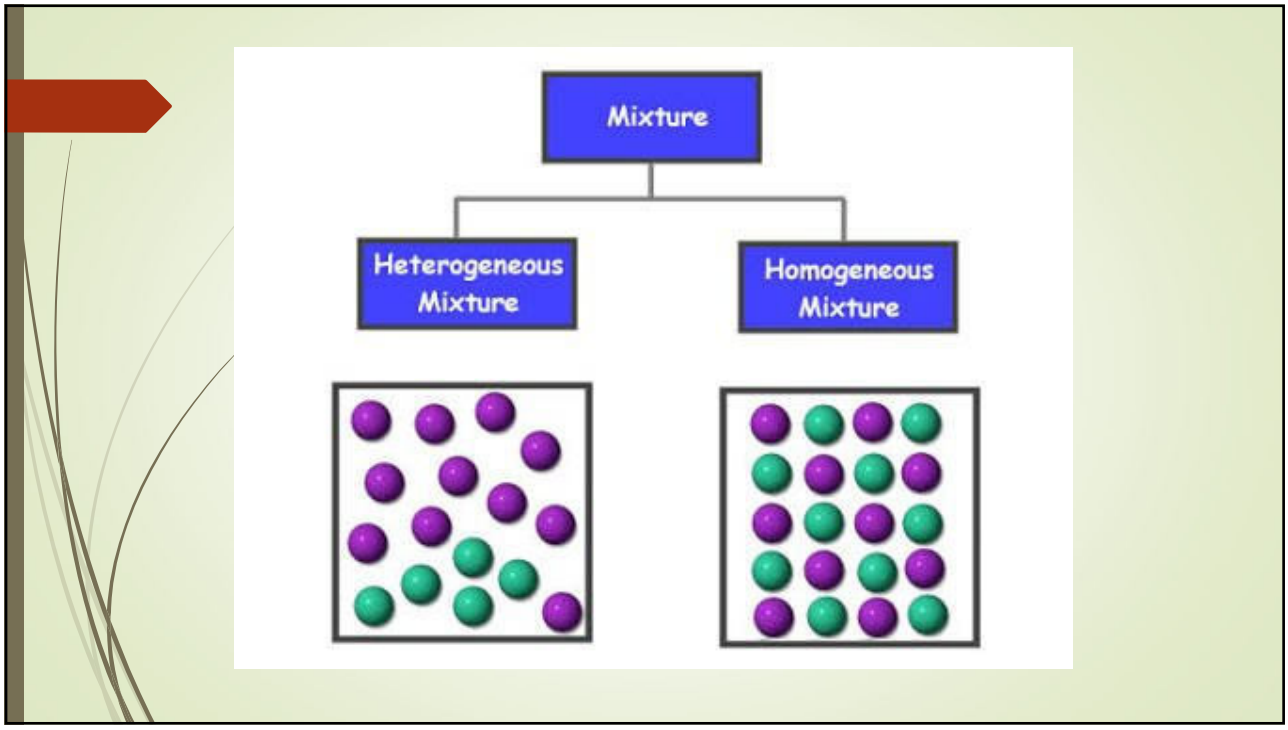

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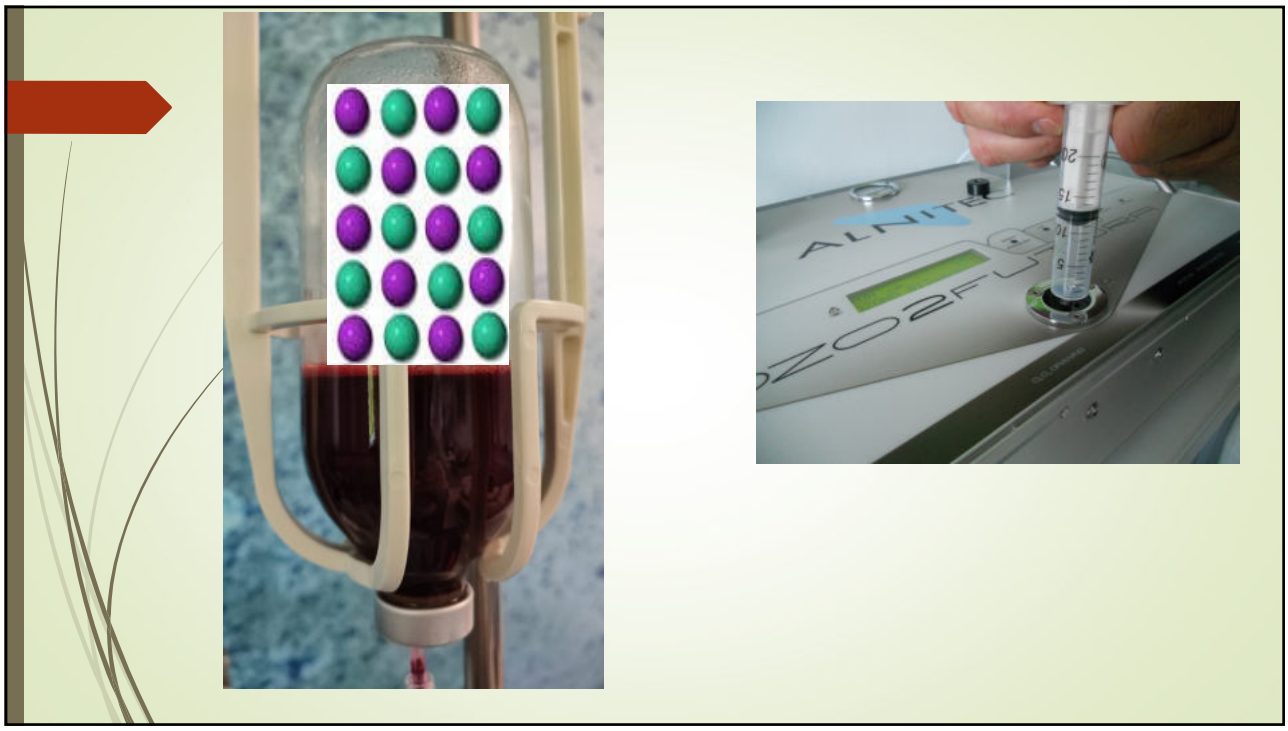

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There's no way of avoiding it
If you mix a gas and a liquid, you get bubbles.

bubble is a globule of a gas substance in a liquid

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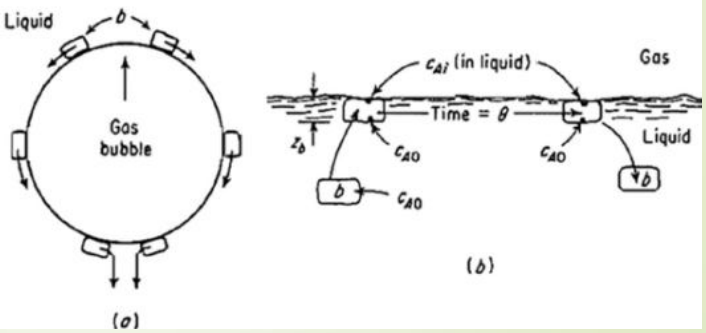
Penetration Theory

This theory explain the mass transfer at fluid surface and this was proposed by Higbie (1935). Higbie emphasized that in many situations the time of exposure for mass transfer is too short and hence, concentration gradient of film theory does not achieve steady state.

This theory describe the contact of two fluids as shown in figure. A bubble of gas rises through a liquid which absorbs the gas.



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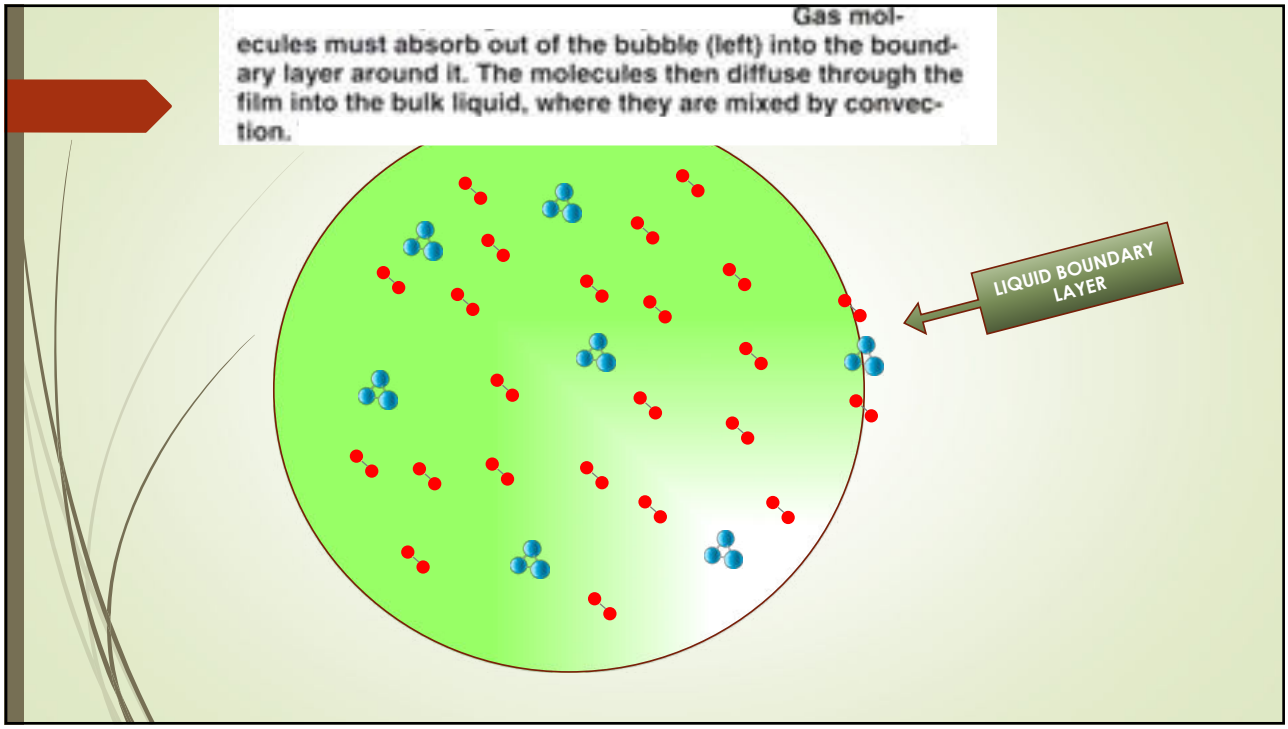
Gas mol-
ecules must absorb out of the bubble (left) into the bound-
ary layer around it. The molecules then diffuse through the
film into the bulk liquid, where they are mixed by convec-
tion.
LIQUID BOUNDARY LAYER

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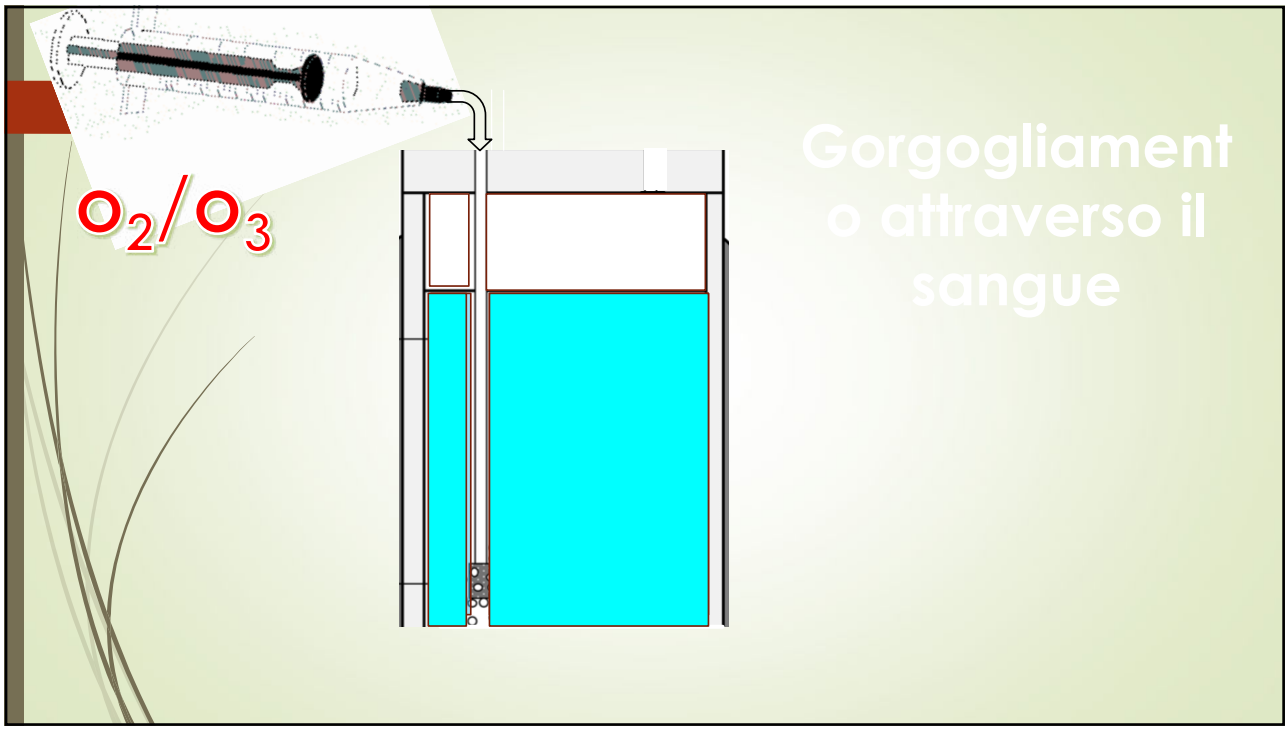
O_2/O_3
Gorgogliamento attraverso il sangue

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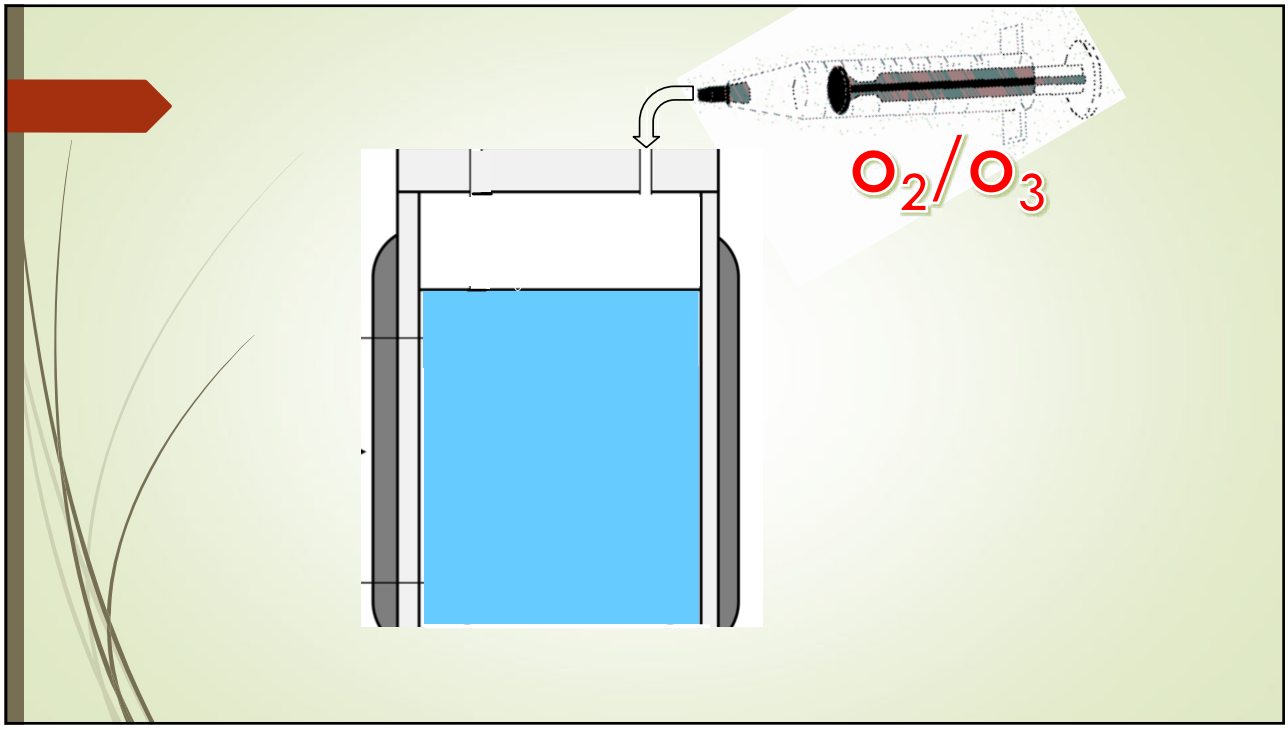

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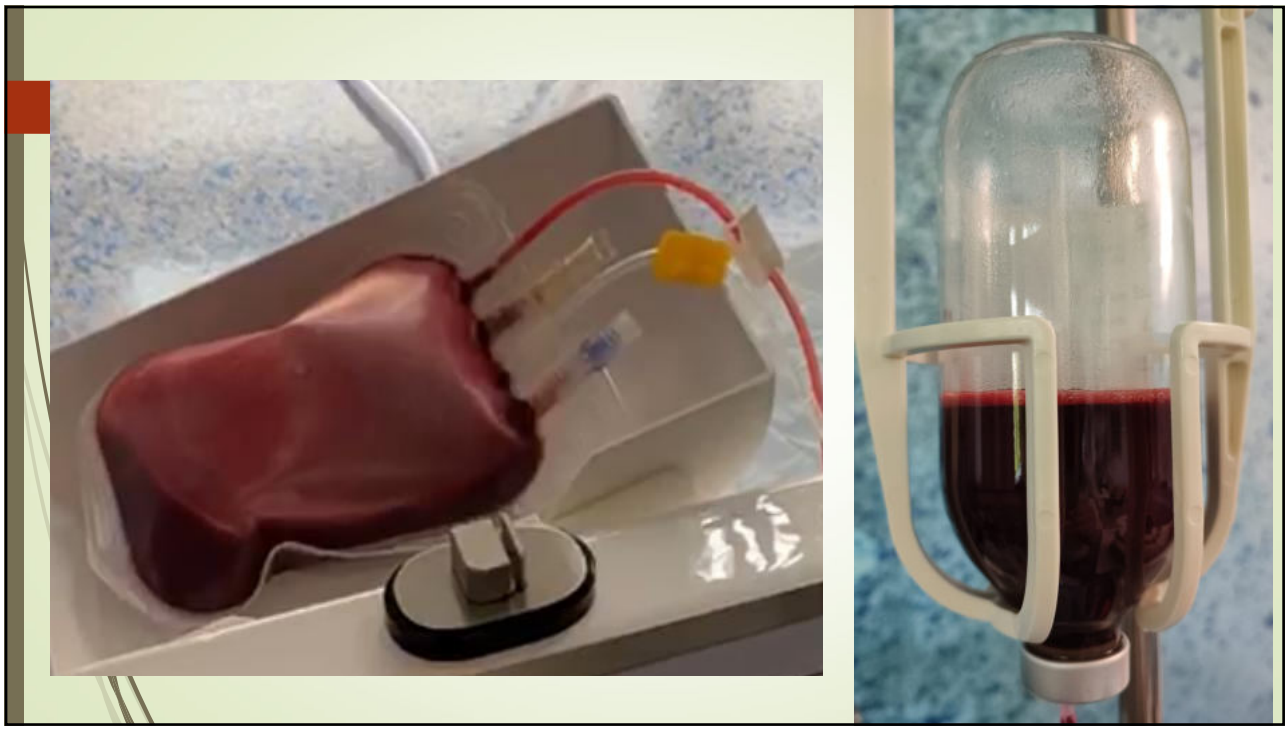

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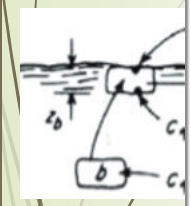
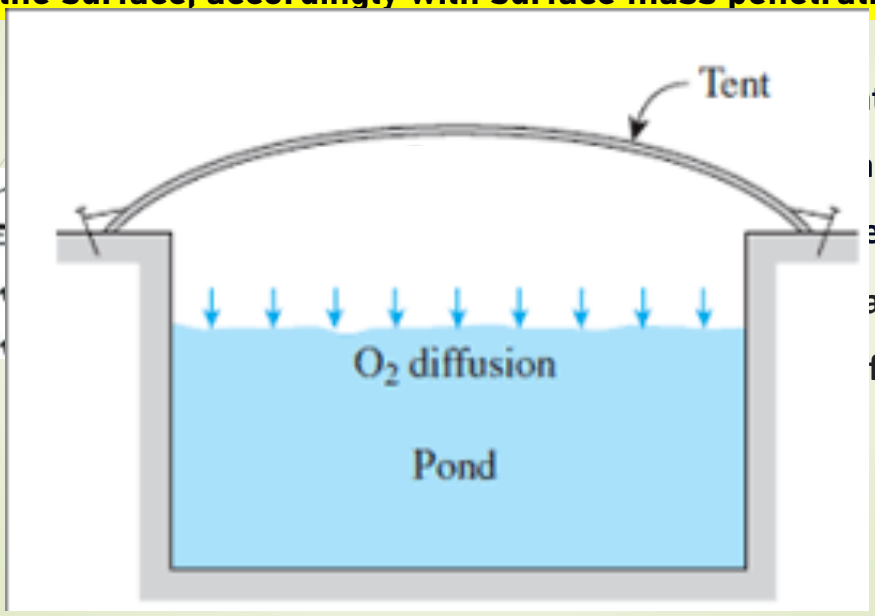
In a stagnant liquid, Gas diffusion in a liquid phase occurs on the surface; accordingly with surface mass penetration theory





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3.5.3 Surface Renewal Theory

For the mass transfer in liquid phase, Danckwert (1951) modified the Higbie's penetration theory. He stated that a portion of the mass transfer surface is replaced with a new surface by the motion of eddies near the surface and proposed the following assumptions:

1) The liquid elements at the interface are being randomly swapped by fresh elements from bulk

2) At any moment, each of the liquid elements at the surface has the same probability of being substituted by fresh element

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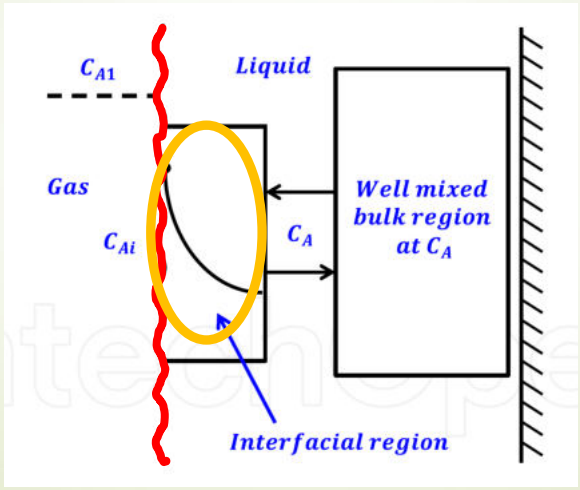
Mass Transfer in Multiphase Systems



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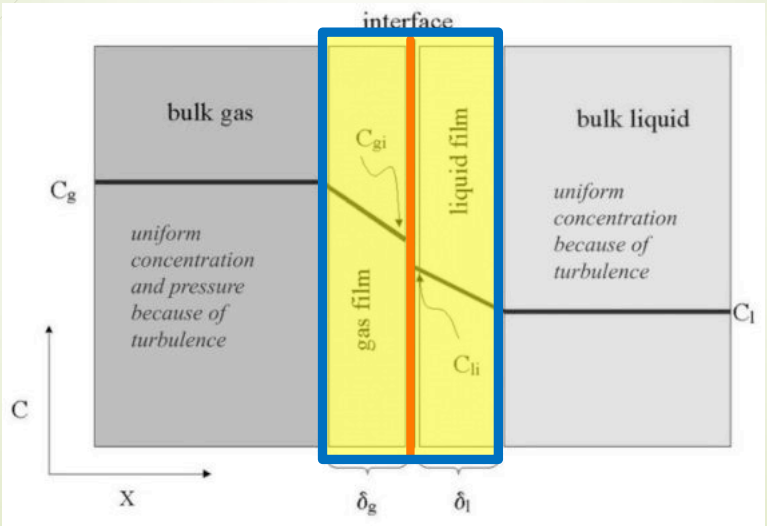
Inter phase mass transfer

Dr. Zifei Liu



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Purpose

Propose a bed side method to guarantee an adequate blood ozonisation following the procedure proposed by Bocci

***Bocci**; Oxygen/ozone as a medical gas mixture*
Medical Gas Research 2011, 1:6

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Blood ozonisation

- Withdrawal of 225-250 ml of blood
- 20 ml of sodium citrate 3.8%
- 225 of O_2/O_3 mixture 40 mcg/ml
- 5-8 minutes of mixing for a complete gas-fluid interaction
- Blood reinfusion

Bocci et al. **Oxygen/ozone as a medical gas mixture. A critical evaluation of the various methods clarifies positive and negative aspects.**
Medical Gas Research 2011, 1:6

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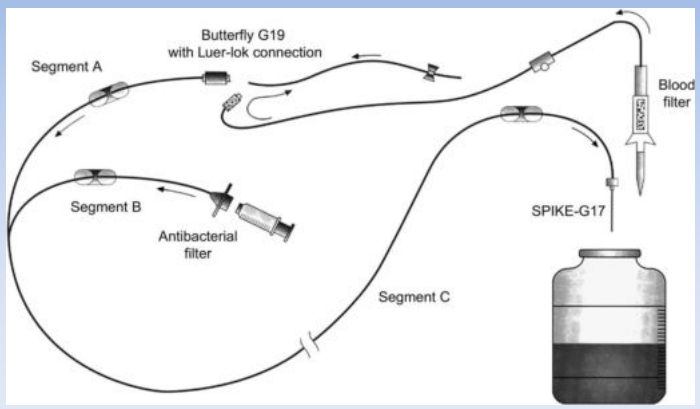
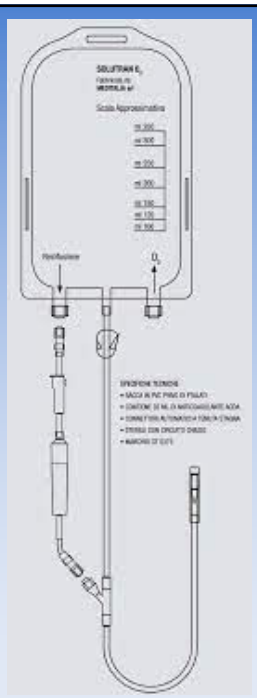
Bottle or bag?





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Material and method

- 250 ml of blood sample in a bag using a tilting scale for blood collection
- Haemogasanalysis
- Insertion of 250 ml of O_2/O_3 mixture (40 mcg/ml di O_3)
- Leaving the bag tilting on the scale for 10 minutes
- Hemogasanalysis
- Manual tilting for 5 minutes
- Hemogasanalysis

paO_2 as an index of adequate blood/gaseous phase mixture

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Ozonoterapia sistemica

Risultati			Crit. Basso	Riferimento Basso	Riferimento Alto	Crit. Alto
Misurati (37.0°C)						
pH	↓ 7.07		[--	7.32	7.45	--]
pCO_2	↑ 67	mmHg	[--	38	51	--]
pO_2	45	mmHg	[--	30	50	--]
Glu	Incalc	mg/dL	[--	70	100	--]
CO-Ossimetro						
O_2Hb	68.4	%	[--	--	--	--]
sO_2	69.7	%	[--	--	--	--]
$HCO_3^-(c)$	↓ 19.4	mmol/L	[--	22.0	29.0	--]

↑↓ Fuori limite di riferimento

Haemo gas analisys at the end of withdrawal

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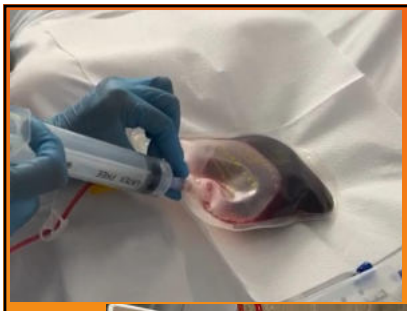

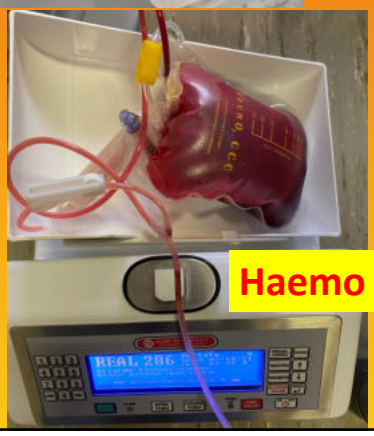

Risultati			Crit. Basso	Riferimento Basso	Riferimento Alto	Crit. Alto
Misurati (37.0°C)						
pH	↓ 6.86		[--	7.32	7.45	--]
pCO_2	↑ 80	mmHg	[--	38	51	--]
pO_2	↑ 148	mmHg	[--	30	50	--]
Hct	37	%	[--	35	51	--]
CO-Ossimetro						
sO_2	99.1	%	[--	--	--	--]
Derivati						
BEecf	-19.2	mmol/L	[--	--	--	--]
$HCO_3^-(c)$	↓ 14.3	mmol/L	[--	22.0	29.0	--]

↑↓ Fuori limite di riferimento

Altre informazioni

Commenti
O3 BILANCIA

Haemo gas analisys after 10 minute tilting on a scale

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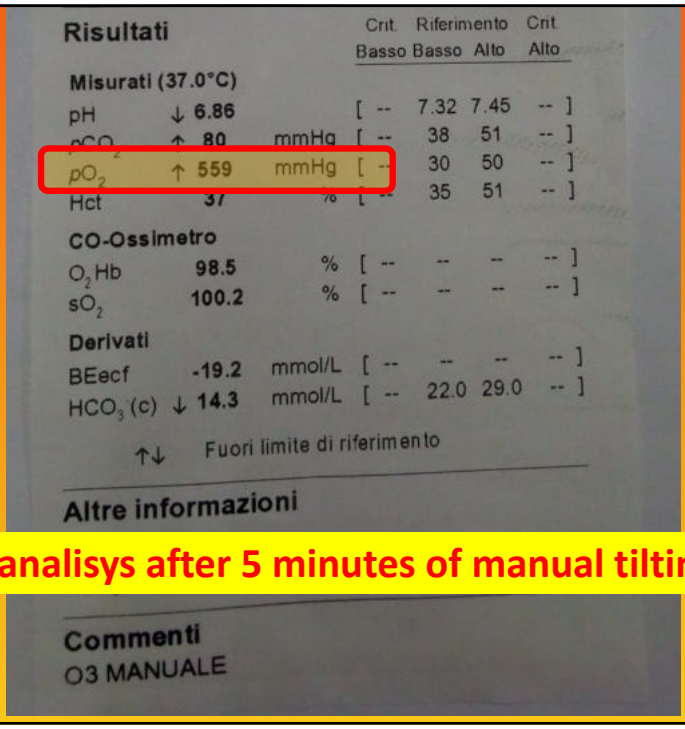

Risultati

			Crit. Basso	Riferimento Basso	Riferimento Alto	Crit. Alto
Misurati (37.0°C)						
pH	↓ 6.86		[--	7.32	7.45	--]
pCO_2	↑ 80	mmHg	[--	38	51	--]
pO_2	↑ 559	mmHg	[--	30	50	--]
Hct	37	%	[--	35	51	--]
CO-Ossimetro						
O_2Hb	98.5	%	[--	--	--	--]
sO_2	100.2	%	[--	--	--	--]
Derivati						
BEecf	-19.2	mmol/L	[--	--	--	--]
HCO_3 (c)	↓ 14.3	mmol/L	[--	22.0	29.0	--]

↑↓ Fuori limite di riferimento

Altre informazioni

Commenti
O3 MANUALE

Haemo gas analisys after 5 minutes of manual tilting

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Patient	mm Hg basal	mm Hg scale mixing	mm Hg manual mixing
1	45	148	559
2	29	55	471
3	62	276	333
4	39	125	412
5	31	103	435
6	77	139	404
7	51	198	426
8	31	71	397
9	58	169	519
10	69	133	478
Average	49	142 (+290%)	443 (+904%)

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Conclusions

- Blood ozonisation using only the titlting scale does **not** guarantee an adequate blood/gaseous mixture mixing with a risk that some Ozone molecules hav not inetract with blood;
- It may reduce the efficacy of the therapy because an inder exposition to O3.

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